

CLASS 95, GAS SEPARATION: PROCESSES**SECTION I - CLASS DEFINITION**

This class provides for processes involving steps resulting in separation of a gas from a fluid mixture comprising (i) a gas and solid or liquid particles entrained therein, (ii) a liquid and gas entrained therein, or (iii) a plurality of gases. As a general rule for this class, there must be a relationship of process steps embracing: (a) inflow of the fluid mixture to be treated, (b) a step or steps effective to cause the separation into constituent parts, and (c) an outflow of at least one constituent which is separate and distinct from the outflow of another constituent, including outflow of a constituent by removing the separating medium itself. The gas separation for this class is effected by processes other than chemical reaction.

The basic subject matter of this class is of a subcombinational nature and may include only such ancillary process steps (e.g., fluid handling, etc.) as are necessary to perfect the gas separating function. Significant inclusion in a claim of features beyond merely perfecting the gas separating function indicates classification in a more comprehensive class. Thus, the combination of a gas separation process of this class and any cleaning or regenerating of the separation media is properly in this class, because the cleaning or regenerating is perfecting the gas separating function. Generally, however, the mere naming of an art process in a claim to gas separation does not affect classification. Thus, a claim to filtration of a gas from a named source with no details of that source is proper for this class.

- (1) Note. The gas separation processes for this class generally involve the use of physical chemistry, chromatography, solid sorption, gas and liquid contact, gas contact, electrical fields, magnetic fields, wave energy, selective diffusion, filtration, deflection, or other mechanical means. (Also see Lines with Other Classes, below.)
- (2) Note. This class also provides for processes in which the fluid mixture is treated to change its make-up, but no real separation occurs, provided no other suitable classification exists. Accordingly, in this class are found processes of using "spark arresters," which merely change the size of particles entrained in a gas. These devices are usually deflectors or screens. The processes of using them are included in this class

because of their similarity to processes which actually separate the fluid mixture into constituent parts. Similarly, agglomeration, which by itself may not separate particles entrained in a gas, but cause small particles entrained therein to join together or coalesce to form larger particles, is in this class unless basis for other classification exists.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

The gas separation processes for this class generally involve the use of physical chemistry, chromatography, solid sorption, gas and liquid contact, gas contact, electrical fields, magnetic fields, wave energy, selective diffusion, filtration, deflection, or other mechanical means. See the class search note in section III for Class 423, Chemistry of Inorganic Compounds, for the line concerning the processes in which the gas separation is caused by a chemical reaction. Also, see the class search note in section III for Class 588, Hazardous or Toxic Waste Destruction or Containment, for the line concerning the processes in which the gas separation is caused by destruction or permanent containment of the hazardous or toxic waste.

Degassing or purging processes for the removal of a gas from a solid will be placed in the class where the solid is either manufactured or treated. The removal of a gas from a solid sorbent (i.e., regeneration), per se, will be found in Class 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making. However, the use of a solid sorbent to separate a gas from a fluid mixture and the removal of the gas from the solid sorbent (i.e., regeneration) will be found in this class. For the removal of a gas from a solid, where the solid is not identified, see Class 134, Cleaning and Liquid Contact With Solids.

The Search Notes below also contain lines with other classes.

SECTION III - REFERENCES TO OTHER CLASSES**SEE OR SEARCH CLASS:**

- 29, Metal Working, appropriate subclasses indented under subclass 592, particularly subclass 896.62 for processes of mechanical manufacture for making a filter.

- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for generic processes for separating liquids from solids (i.e., drying) and the contacting of solids with either gases or vapors. Class 95 takes the separation of a gas from a fluid mixture in combination with the regeneration of the separating media by drying or by gas or vapor contact.
- 47, Plant Husbandry, appropriate subclasses for processes of separation of a gas from a fluid mixture by use of a plant of higher order.
- 48, Gas: Heating and Illuminating, appropriate subclasses for processes for the manufacture of heating and illuminating gases.
- 60, Power Plants, subclasses 273+ for processes of treating or handling the materials discharging from the combustion chamber of an internal combustion engine.
- 62, Refrigeration, appropriate subclasses for processes peculiar to removing heat from a substance, usually by a change of phase of a coolant or refrigerant and for processes involving subject matter for Class 95 combined with a significant refrigeration step. Examples of significant refrigeration are: (i) expansion of a gas through an orifice whereby cooling is effected to condense any of the constituents of the gas by such temperature reduction; (ii) a significant physical relationship or arrangement between elements of a refrigeration circuit (e.g., two related refrigeration coils, detailed description of the circuit, etc.); (iii) change of phase of a coolant or refrigerant (i.e., evaporation, melting, or sublimation) whereby cooling is effected to condense any of the constituents of the gas by such temperature reduction. Some examples of what may be found in Class 62 are: (a) separation of a constituent from a plurality of gases by a significantly claimed refrigeration step or apparatus; (b) condensation of moisture from the atmosphere as a result of a refrigeration operation; (c) gas drying by sorption followed by contacting the dried gas with a liquid to produce cooling by evaporation; (d) a refrigerated enclosure combined with sorption means; (e) refrigeration producing processes and apparatus combined with steps or means for drying the refrigerant; and (f) extracting a constituent from a plurality of gases by liquefaction and separation (e.g., fractionation or distillation, etc.). Class 95 takes gas separation of general application, including cooling of the sorbent or cooling of gas, but not including evaporative cooling after sorption of the type noted in (c) above. Class 95 takes the cold wall-hot wall thermal diffusion or repulsion type of separation, regardless of any refrigeration claimed. Class 95 also takes expansion through an orifice of a liquid and gas entrained therein where the gas is removed from the liquid through the lowering of the pressure and the cooling effect which inherently results from such pressure reduction is not transferred through a wall to another material; if such heat transfer occurs, classification in Class 62 is proper.
- 73, Measuring and Testing, subclasses 23.2+ for gas analysis, per se, and also the combination of gas separation and significant gas analysis. The combination of gas separation and a nominal step of "analyzing" or "detecting" without further detail of the analysis or detection is insufficient to cause a patent to be placed in Class 73; that patent will be placed in Class 95. Also, if there is feedback from the analytical apparatus to control or effect a change in the gas separating operation, then classification is in Class 95.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes for the treatment of liquid or vaporous metal. See subclass 405 for removal of gas from liquid metal by use of a gas permeable membrane and subclasses 407+ for filtering vaporous metal.
- 96, Gas Separation: Apparatus, for the corresponding apparatus to the processes of Class 95. When a patent has a claim or claims to a Class 95 process and a claim or claims to a Class 96 apparatus, the patent will be placed as an original in Class 95, even though there may be an apparatus claim that is more comprehensive than a process claim.
- 128, Surgery, subclasses 200.24+ for methods of supplying a breathable gas to, or exhausting such gas from, a living body. Subclass 200.24 and the subclasses mentioned below require that the method be adapted for use on or in the living body and also include diagnostic or therapeutic methods when the only disclosed utility is for diagnosis or treatment of a living body. See especially subclass 200.25 for an artificial gill or means for separating entrained air from a liquid stream; subclass 201.25 for a respiratory device including body or head supported means covering user's scalp and means for

- removing a substance from respiratory gas; subclass 204.16 for removal of a substance from respiratory gas by cooling; subclass 205.12 for means for supplying respiratory gas under positive pressure including means for removing a substance from the respiratory gas; and subclass 205.27 for a respiratory device including means for removing a substance from respiratory gas.
- 137, Fluid Handling, appropriate subclasses for combinations of fluid handling and gas separation involving more than mere flow control to or from the separating means. (a) For classification in either Class 137 or Class 95, where both the fluid handling and gas separation are included in the combination, classification will be based upon the ultimate purpose of the subject matter and not upon the ancillary or subordinate feature of the combination consistent with the objects and aims therefor (e.g., it is not intended that the inclusion of filtering, no matter how specifically defined, will be sufficient to carry a "gas field storage and distribution process" to Class 95 whether the filtering protects the apparatus used in the process or is the last step in the process). The fluid handling for Class 95 should be no more than that necessary to convey or conduct the fluid mixture to, at, or away from the point of separation. (b) Class 137 also takes separation of gases from gases, liquids, or solids by gravity only (i.e., where no specific means is claimed for effecting the separation).
- 140, Wireworking, subclasses 3+ for wire fabric making.
- 141, Fluent Material Handling, With Receiver or Receiver Coacting Means, subclasses 4+ for processes of transferring fluent material through a flow confining system, the source and receiver parts of which are normally separable, including varying gaseous conditions (e.g., causing a vacuum, etc.) in the receiver.
- 156, Adhesive Bonding and Miscellaneous Chemical Manufacture, appropriate subclasses for processes there classified for adhesively bonding and otherwise manufacturing filters.
- 165, Heat Exchange, appropriate subclasses for processes where only indirect heat exchange is involved and especially subclasses 201+ and 58+ for heating and cooling including addition or removal of water vapor from air. Cold wall-hot wall thermal diffusion processes will be found in Class 95, subclass 289.
- 166, Wells, for processes involving shafts or deep borings in the earth for the extraction of fluids from the earth. See especially subclasses 265+ for processes involving separating material leaving the well. A gas separation process including a nominal recitation of a well process is proper for Class 95. For classification in Class 166, some details specific to a well process should be recited for the combination of a gas separation process and a well process. However, in the situation in which one of the constituents separated is inserted into an input well, a mere broad recitation of such well process is sufficient for classification in Class 166.
- 203, Distillation: Processes, Separatory, subclasses 39+ for processes for separating a liquid mixture (distilland) by vaporizing and condensing at least a portion thereof to isolate in the condensed liquid (distillate) or in the unvaporized portion (residue) a comparatively pure compound combined with subjecting the vapor to a disparate physical treatment to remove a substance. For Class 203, the liquid mixture (distilland) must have a boiling point above 0°C under normal atmospheric pressure (760 mm Hg).
- 204, Chemistry: Electrical and Wave Energy, appropriate subclasses for processes in which a chemical change is brought about by the application of an electric current or wave energy to material being treated wherein more than the mere thermal effect of the current or energy is involved and subclasses 554+ for processes for the separation or purification of liquids by the physical or physical-chemical action of an electrical stress. See particularly subclass 157.3 for processes in which an initial normally gaseous mixture is treated by wave energy so as to remove therefrom by a chemical reaction or change to a different chemical form at least one of the components therein.
- 208, Mineral Oils: Processes and Products, for processes for the recovery or treatment of naturally occurring mineral oil which result in the production of a purified or modified mineral oil. See particularly subclass 310 for the separation of mineral oils into hydrocarbon fractions, at least one of which is a mineral oil, wherein a mineral oil containing fluid mixture is contacted with a solid material which selectively adsorbs a mineral oil fraction from the fluid mixture. See also subclass 340 for the recovery of liquid mineral oils from natural gases or from uncondensed gas-vapor mixtures

- obtained from a mineral oil conversion operation including separation of mineral oils into hydrocarbon fractions, at least one of which is a mineral oil. Processes which involve a gas separation procedure classifiable in Class 95 followed by the recovery of a mineral oil by name only (e.g., reciting only rectification, vacuum pressure or flash distillation, etc.) are classified in Class 95. Processes wherein the mineral oil recovery step includes any details thereof or includes some subsequent treatment of the separated mineral oil are classified in Class 208.
- 209, Classifying, Separating, and Assorting Solids, subclasses indented under subclass 21 and 133 that include "deposition" in their titles for processes for the separating and segregating into grades components of solid mixtures employing a gaseous suspending medium which is separated from the solids.
- 210, Liquid Purification or Separation, appropriate subclasses for the separation of a constituent from a flowable liquid mixture; except for the separation of a gas initially present in a liquid mixture. Class 210 is superior to Class 95 and takes separating processes, per se, generically disclosed or claimed as fluid separation or if the disclosure or a claim is restricted to liquid separation. Class 210 also takes processes which remove or vent gas formed incidentally to the handling of the fluid mixture or as a result of a Class 210 treatment (see particularly subclass 603, 640, 664, 718, and 750). However, Class 95 takes processes operating to remove gas initially present in an inflowing liquid mixture, with or without liquid separation. The removal of a volatile organic compound (e.g., ethanol (C_2H_5OH), gasoline, etc.) from a liquid is not taken to be degasification of a liquid for Class 95 when the volatile organic compound is initially present as a liquid mixed with another liquid. The removal of a volatile organic compound from a liquid may be found in Class 210 for liquid purification or separation or Class 203 for separatory distillation processes. Class 95 will also take a process including a liquid separation step in a Class 95 operation (e.g., regenerating a scrubbing liquid in a gas scrubbing operation).
- 241, Solid Material Comminution or Disintegration, subclasses 18+ for processes for combinations of comminution and separation of solids from a gas. Class 241 is superior to the material separation classes and, therefore, provides for processes in which comminution is combined with steps to separate the material into classes according to the physical characteristics of its components before, during, or after the comminuting operation. Class 95 takes processes, such as deflection or the like, that may act to comminute material as a secondary or incidental function of what is basically a holding back or separating procedure (e.g., disintegration or attrition of ignited particles in spark arresters). Such processes are classified on the basis of their essential function in Class 95.
- 250, Radiant Energy, subclasses 282+ for methods for the ionic separation of materials utilizing the charge-to-mass ratios of particles. These methods may be for subjecting the ionized particles to the effects of an electric or magnetic field, which causes the particles to travel through a curved trajectory, the particles of a certain charge-to-mass ratio having a trajectory different from those particles having other charge-to-mass ratios.
- 252, Compositions, subclasses 189+ for substances (e.g., liquid sorbent compositions, etc.) for use in absorbing or binding carbon monoxide (CO), sulfur (S), negative elements, or acids; subclass 193 for substances (e.g., liquid sorbent compositions, etc.) for use in absorbing or binding ammonia, alkalis, or other bases; and subclass 194 for substances (e.g., liquid sorbent compositions, etc.) for use in absorbing or binding water.
- 261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus for degasifying liquid (e.g., deaerating feed water heater, etc.) wherein the liquid is merely contacted with a gas in a chamber or space for deaeration thereof; for apparatus wherein a gaseous fluid mixture is contacted with a liquid spray, sheet, stream, or bath to precipitate dust or to sorb a constituent from the gaseous fluid mixture; for apparatus comprising a nonabsorbent element on which a gaseous fluid mixture is contacted with a liquid if the element is continuously supplied with a liquid or is continuously moved into and out of a liquid bath or supply; and for apparatus comprising an absorbent porous sheet or mass on which a gaseous fluid mixture is contacted with a liquid if the sheet or mass is: (a) continuously supplied with liquid, (b) cyclically or periodically moved through a liquid reservoir, (c) maintained wet by liquid applying means, or (d) moistened by maintaining some part of a continuous wick type mem-

- ber immersed in liquid, by following the law of the machine, or during normal operation of a gas contacting function. Note that under the provisions of (a) and (b) there must be no affirmative means to dry the sheet or mass, nor means to assure a dry condition of the sheet or mass before gas flow is resumed or the sheet or mass is returned to the gas contacting position. If apparatus for degasifying liquid by contact with a gas has other means to cause gas separation of the liquid with gas entrained therein, of the separated gas, or of the separated liquid, then the apparatus is classified in Class 96. If apparatus in which a gaseous fluid mixture is contacted with a liquid to precipitate dust or to sorb a constituent from the gaseous fluid mixture has other means to cause gas separation or has means to treat the contact liquid, then the apparatus is classified in Class 96.
- (1) Note. Apparatus for separating ammonia (NH_3) or acid anhydrides (CO_2 , SO_2 , etc.) from a gas by mere contact with a liquid is classified in Class 261.
 - (2) Note. Processes for gas separation by contacting a gaseous fluid mixture with a liquid and processes of degasifying a liquid are classified in Class 95.
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, for processes for induced nuclear reactions combined with steps for reaction product treatment. See particularly subclasses 146+, 189, 195, 198, and 201. See subclasses 308+ for processes including fission reactor material treatment.
- 406, Conveyors: Fluid Current, subclasses 154+ for processes to convey solid material in a fluid current with separation of the solids from the fluid at the conveyor outlet.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving or Sterilizing, subclass 4 for processes of acting on a gas for maintaining a protective environment or counteracting a destructive environment by disinfecting, deodorizing, preserving, or sterilizing. The deodorizing for Class 422 generally involves adding a substance to a gas to mask an odor. Class 95 takes deodorizing a gas that involves gas separation of the type that meets the requirements for gas separation in the definition for Class 95. Class 422 is the residual place for deodorizing a gas that does not meet the requirements of the definitions for Class 95 or Class 423.
- 423, Chemistry of Inorganic Compounds, subclasses 210+ for gas separation methods relying upon a chemical reaction (including combustion). However, for a Class 95 process including a chemical reaction not involved in the separation, per se, see the Class 95 Glossary for TREATMENT. A particular chemical must be claimed and the chemical reaction must be inherent or disclosed for patents to be placed in Class 423. Broadly reciting the separating material as a "chemical" or as "gas purifying material" does not exclude the patent from Class 95. Absorption and adsorption are not considered chemical reactions in this respect. Processes for separating a gaseous fluid mixture having therein ammonia (NH_3) or acid anhydrides (e.g., CO_2 , SO_2 , etc.) by contacting the gaseous fluid mixture with water and thus dissolving these gases out of the gaseous fluid mixture are in Class 95, notwithstanding the fact that a chemical reaction occurs in the solution and that ammonium hydroxide or the acids are formed. Corresponding gas and liquid contact apparatus, per se, is classified in Class 261. See the search class note for Class 261 in this section for the line. See subclass 658.2 for hydriding an alloy of two or more metals and recovering hydrogen from the hydride.
- 435, Chemistry: Molecular Biology and Microbiology, for processes of using a micro-organism or enzyme to synthesize a chemical product and for processes of treating a material with a micro-organism or enzyme to separate, liberate, or purify a preexisting substance. See particularly subclass 266 for processes of treating a gas, emulsion, or foam with an enzyme or immobilized enzyme or micro-organism or plant or animal cells to isolate or recover a preexisting substance which is chemically unchanged by the process.
- 494, Imperforate Bowl: Centrifugal Separators, for processes for the breaking up or subdividing of material, which material comprises a mixture of fluids or fluent substances, into two or more components by utilizing a rotatable, receptacle-like member having a generally solid wall, and commonly termed a bowl, for subjecting the material to centrifugal force. Thus, gas separation processes that use an imperforate bowl, centrifugal separator are proper for Class 494.

- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, subclasses 20+ for regenerating or rehabilitating solid sorbent compositions, per se, subclasses 60+ for zeolite compositions and for processes of making zeolite compositions, and subclasses 400+ for other solid sorbent compositions and for processes of making solid sorbent compositions. Class 95 will take the combination of gas separation using a solid sorbent composition and regenerating or rehabilitating the solid sorbent composition.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, appropriate subclasses for colloid systems or agents for such systems or making or stabilizing such systems or agents, appropriate subclasses for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of colloid systems (subclasses 115+ for defoaming); in each instance, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 800+ for processes in which a mixture of a hydrocarbon compound with another substance is treated to recover that same compound in a more usable condition, that is, a purer or more desirable condition, by a treatment which comprises separating the hydrocarbon from the other substance or making the other substance less noxious.
- 588, Hazardous or Toxic Waste Destruction or Containment, for hazardous or toxic waste destruction by any means to include heating, chemical action, or the interaction with any form of radiation and hazardous or toxic waste conversion by any means (e.g., chemical, physical, etc.) to an environmentally safe substance. Class 588 includes such destruction or conversion in combination with gas separation.

event is determined (e.g., presence of sparking, change in liquid level determined by position of float, etc.).

FILTER

An article or mass of material made of closely spaced or intimately arranged intermeshed or unconnected fibers, elements, strands, or particles that collectively act as a barrier to physically retain at least one constituent of a fluid mixture on its surfaces or in the spaces between the fibers, elements, strands, or particles while permitting passage of the remaining constituents.

A filter has no “chemical” affinity for a constituent of a fluid mixture. The retention of the constituent by the filter depends upon a mechanical entrapment of solid or liquid particles because of their relatively large size compared with the interstices or spaces between individual fibers, elements, strands, or particles. The retained particles can be removed by brushing, wiping, shaking, or similar mechanical action.

FLUID MIXTURE

The phrase “fluid mixture” is used throughout the definitions to mean (a) a gas and solid or liquid particles entrained therein, (b) a liquid and gas entrained therein, or (c) a plurality of gases.

GAS

Matter of very low density and viscosity, relatively great expansion and contraction with changes in pressure and temperature, that is readily diffusive, with a tendency to expand indefinitely, with molecules in free movement. The term “gas” includes “vapor” (q.v.).

GASEOUS FLUID MIXTURE

The phrase “gaseous fluid mixture” is used throughout the definitions to mean (a) a gas and solid or liquid particles entrained therein or (b) a plurality of gases.

LIQUID SORBENT

A liquid capable of retaining part of a fluid mixture with which it is contacted. The action in most cases is that of selective retention (i.e., the sorbent removes only that part of the fluid mixture for which it has the greatest affinity).

REGENERATION

SECTION IV - GLOSSARY

DETECT

The term “detect,” which is used in many of the control subclasses, is used in both a quantitative and a qualitative sense. This means that a definite measurement of a process variable is made (e.g., temperature, pressure, concentration, etc.) or that the presence of a particular

Restoration of the separatory material to the condition it was in before the separatory process.

SEPARATING APPARATUS

The entire gas separating means, which consists of all of the apparatus parts related to gas separation and includes apparatus parts that are in addition to the separator.

SEPARATING MEDIUM (MEDIA)

Liquid sorbent or means that effects the separation into constituent parts (e.g., deflector, filter, molecular sieve, sorber, etc.). (Media has been used in the singular and in the plural.)

SEPARATOR

The portion of the apparatus that consists of a separating medium and the structure supporting, retaining, or substantially confining the separating medium.

SOLID SORBENT

A solid sorbent is a solid material which separates a constituent (e.g., a gas, vapor, etc.) from a fluid mixture containing such constituents in a "quasi-chemical" manner. The action in most instances is that of selective retention (i.e., the sorbent removes only the part of the fluid mixture for which it has the greatest affinity). The retained constituent cannot be removed by shaking, brushing, or similar mechanical action, but generally can be removed by heating, pressure reduction, or use of a stripping or denuding fluid.

TREATMENT

(a) With respect to the class subject matter, the term is restricted to reversible and nonchemical changes in physical characteristics of the fluid mixture or a separated constituent (e.g., heating, cooling, humidity control, agitating, pressure regulation, etc.). (b) With respect to the media used to perform the gas separation or to a material used to condition the fluid mixture for separation, the term may include chemical preparation, reconditioning, or reaction.

VAPOR

The gaseous state of matter that is liquid or solid under a temperature of 0°C and 760 mm Hg pressure.

SUBCLASSES

1 WITH CONTROL RESPONSIVE TO SENSED CONDITION:

This subclass is indented under the class definition. Process in which the separation is regulated by detecting a characteristic or a change in a characteristic of the process and by implementing an action in the process based upon the detected characteristic or change therein.

- (1) Note. In this subclass and the subclasses indented hereunder, a single means may be used both to detect the characteristic or the change in the characteristic in the process and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by the means because of the detected characteristic or change therein. An example is the use of a pressure relief valve in which a certain pressure must be reached before the valve opens to relieve the high pressure in the process. Another example is the use of a bimetallic element in a thermostat in which a certain temperature must be reached before a switch is tripped in order to control the temperature in the process. A third example is the use of increased weight on a separating media because of accumulation of a separated constituent to cause the separating media to move to a position of nonuse or regeneration. Excluded from this subclass and the subclasses indented hereunder are processes in which there is no positive action made by the single means because of the detected characteristic or change therein. An example of a process which is excluded and placed below is the flow of liquid over a baffle once the liquid level reaches the top of the baffle.

SEE OR SEARCH CLASS:

- 73, Measuring and Testing, subclasses 23.2+ for gas analysis, and see the class definition of Class 95 for a statement of the line.
- 96, Gas Separation: Apparatus, subclasses 18+ for electrical separation apparatus with control means respon-

- sive to sensed condition; subclass 102 for chromatography apparatus with control means responsive to sensed condition; subclasses 109+ for solid sorbent apparatus with control means responsive to sensed condition; subclasses 156+ for degasifying means with control means responsive to sensed condition; subclasses 397+ for gas separation apparatus with automatic control means for gas or non-gaseous constituent discharge; and subclasses 417+ for gas separation apparatus with signals, indicators, measuring, or testing means.
- 2 Electric or electrostatic field (e.g., electrostatic precipitation, etc.):**
This subclass is indented under subclass 1. Process in which there is a step including discharge of an electric current into the fluid mixture or electrifying a fluid or solid that contacts the fluid mixture.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
57+, for processes using electric or electrostatic fields without control responsive to a sensed condition.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 18+ for electrical separation apparatus with control means responsive to sensed condition.
- 3 Concentration sensed:**
This subclass is indented under subclass 2. Process in which concentration of a constituent present in the process or a change therein (e.g., dust, humidity, etc.) is detected and is used to control some aspect of the process.
- 4 Temperature sensed:**
This subclass is indented under subclass 2. Process in which temperature or a change therein is detected and is used to control some aspect of the process.
- 5 Sparking sensed:**
This subclass is indented under subclass 2. Process in which the presence or frequency of sparking in the gas phase, often accompanied by short bursts of increasing current flow or decreasing electrode voltage, is detected and is used to control some aspect of the process.
- 6 Current sensed:**
This subclass is indented under subclass 2. Process in which current flowing between discharge and collector electrodes or a change therein is detected and is used to control some aspect of the process.
- 7 Voltage sensed:**
This subclass is indented under subclass 2. Process in which voltage applied, either directly to an electrode or indirectly to the fluid mixture, or a change therein is detected and is used to control some aspect of the process.
- 8 Concentration sensed:**
This subclass is indented under subclass 1. Process in which concentration of a constituent present in the process or a change therein (e.g., pH, humidity, dust content, etc.) is detected and is used to control some aspect of the process.
- 9 pH sensed:**
This subclass is indented under subclass 8. Process in which pH or a change therein is detected and is used to control some aspect of the process.
- 10 Humidity sensed:**
This subclass is indented under subclass 8. Process in which humidity or a change therein is detected and is used to control some aspect of the process.
- 11 Flow of fluid mixture to sorber stopped or diverted to other equipment, or sorbent regenerated:**
This subclass is indented under subclass 8. Process in which the flow of the fluid mixture to a sorber is stopped or the flow of the fluid mixture is switched to another sorber based upon the detected concentration or change therein; or process in which a sorbent is regenerated based upon the detected concentration or change therein.
- 12 Gas flow rate modified:**
This subclass is indented under subclass 8. Process in which flow rate of a gas is changed based upon the detected concentration or change therein.

- 13 Sorbent flow rate modified:**
This subclass is indented under subclass 8. Process in which flow rate of a sorbent is changed based upon the detected concentration or change therein.
- 14 Temperature sensed:**
This subclass is indented under subclass 1. Process in which temperature or a change therein is detected and is used to control some aspect of the process.
- 15 And pressure sensed:**
This subclass is indented under subclass 14. Process in which pressure or a change therein is also detected and is used to control some aspect of the process.
- 16 Modification of flow rate of liquid which is added to gas:**
This subclass is indented under subclass 14. Process in which flow rate of liquid which is added to a gas is modified based upon the detected temperature or change therein.
- 17 Cooling:**
This subclass is indented under subclass 14. Process in which the fluid mixture, a separated constituent, or an apparatus involved in the process is cooled based upon the detected temperature or change therein.
- 18 Heating:**
This subclass is indented under subclass 14. Process in which the fluid mixture, a separated constituent, or an apparatus involved in the process is heated based upon the detected temperature or change therein.
- 19 Pressure sensed:**
This subclass is indented under subclass 1. Process in which pressure or a change therein is detected and is used to control some aspect of the process.
- 20 Apparatus cleaned:**
This subclass is indented under subclass 19. Process in which apparatus is cleaned based upon the detected pressure or change therein.
- 21 Sorbent regenerated:**
This subclass is indented under subclass 19. Process in which a sorbent is regenerated based upon the detected pressure or change therein.
- 22 Gas flow rate modified:**
This subclass is indented under subclass 19. Process in which flow rate of a gas is changed based upon the detected pressure or change therein.
- 23 Gas flow rate sensed:**
This subclass is indented under subclass 1. Process in which gas flow rate or a change therein is detected and is used to control some aspect of the process.
- 24 Liquid level sensed:**
This subclass is indented under subclass 1. Process in which liquid level or a change therein is detected and is used to control some aspect of the process.
- 25 WITH RECORDING OR SIGNALING CONDITION:**
This subclass is indented under the class definition. Process in which a characteristic or a change in a characteristic of the fluid mixture, of a separated constituent, or of apparatus used in the process is set down for preservation in permanent form or is indicated by means giving information of an audible or a visual nature (e.g., alarm, etc.).
- SEE OR SEARCH CLASS:
73, Measuring and Testing, subclasses 23.2+ for gas analysis and see the class definition of Class 95 for a statement of the line.
- 26 WITH TIMING OF OPERATION:**
This subclass is indented under the class definition. Process in which the time at which an operation occurs is controlled or the length of time in which an operation is performed is controlled.
- 27 MAGNETIZED PARTICLE BED:**
This subclass is indented under the class definition. Process in which magnetic lines of force are applied to a bed of loose particles that contain a magnetizable component.

- (1) Note. The application of magnetic lines of force to a magnetizable particle bed may be to stabilize the bed, to prevent back-mixing, or to control porosity of the bed.

28 **MAGNETIC SEPARATION:**

This subclass is indented under the class definition. Process in which the separation is caused or aided by magnetic lines of force.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 1+ for apparatus which separates a gas by magnetic lines of force.
- 209, Classifying, Separating, and Assorting Solids, subclass 38, 39, 40, 212, and 213+ for classifying, separating, and assorting solids using apparatus of the magnetic type.
- 210, Liquid Purification or Separation, subclasses 222+ for magnetic apparatus for purification or separation of a liquid and subclass 695 for processes of purifying or separating a liquid using magnetic force.

29 **SOUND WAVES USED:**

This subclass is indented under the class definition. Process in which the separation is effected or enhanced by the energy of compressional vibratory waves in a fluid medium, the waves being below, within, or above the audible spectrum.

- (1) Note. Pressure pulses in a fluid generated merely by intermittent discharge of a gas are not considered to be compressional vibratory waves under this definition. However, compressional vibratory waves under this definition may be produced by intermittent discharge of a gas, as in a siren.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclass 292 for cleaning means for separating media of the sonic type.
- 96, Gas Separation: Apparatus, subclass 389 for gas separation apparatus using wound waves.

30

Degasification of liquid:

This subclass is indented under subclass 29. Process in which the wave energy is used to separate gas from a liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 46, for processes of degasification of a liquid by selective diffusion of gases through a substantially solid barrier.
- 156+, for processes of contacting a gas with a liquid and degasification of the contact liquid.
- 241+, for other processes of degasification of a liquid.

31

DIFFERENCE IN MOLECULAR VELOCITY, DENSITY, OR MOMENTUM OF GASES USED:

This subclass is indented under the class definition. Process in which the plurality of gases is separated into constituent gaseous parts by making use of physical differences in molecular speed, weight, or inertia of the constituent gaseous parts.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 267+, for processes of separating solid or liquid particles from a gas by deflection.

32

Passing gases through nozzle:

This subclass is indented under subclass 31. Process in which gaseous constituents having different molecular weights or different gas kinetic cross sections are separated, with the plurality of gases flowing out of a short tube, usually tapering, that forms the vent of a hose or pipe in order to effect the separation.

33

Directing gas streams toward one another:

This subclass is indented under subclass 32. Process in which gas streams or jets are directed toward one another and are deflected.

34

Centrifugal force:

This subclass is indented under subclass 31. Process in which the plurality of gases is separated by the effect of centrifugal action which causes the gases to assume a rapid arcuate or circular movement, with this movement causing the constituents of the mixture to separate

- into more or less distinct layers, depending upon the density of the constituents.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
269+, for processes of separating solid or liquid particles from a gas by using centrifugal force.
- 35 Created by rotating equipment:**
This subclass is indented under subclass 34. Process in which the centrifugal force is caused by a rotating element moving around an axis.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
270, for processes of separating solid or liquid particles from a gas by using centrifugal force created by rotating equipment.
- 36 LIQUID-SOLID SLURRY USED:**
This subclass is indented under the class definition. Process in which the separation is accomplished by contacting the fluid mixture with a pumpable mixture of a solid and a liquid.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
92, for a two-step process of solid sorption and liquid sorption.
- 37 Organic compound removed from gas**
This subclass is indented under subclass 36. Process in which an organic compound is removed from gas by contact with a liquid-solid slurry.
- 38 Halogen containing compound removed from gas:**
This subclass is indented under subclass 36. Process in which a halogen (i.e., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) containing compound is removed from gas by contact with a liquid-solid slurry.
- 39 COMPRESSING AND INDIRECT COOLING OF GASEOUS FLUID MIXTURE TO SEPARATE:**
This subclass is indented under the class definition. Process in which the separation of a constituent from a gaseous fluid mixture is accomplished by extracting heat in an indirect heat exchanger before, after, or while increasing the pressure on the gaseous fluid mixture.
- (1) Note. The cooling must not involve details of a refrigeration process or apparatus. See the class definition for the line between Class 95 and Class 62.
- 40 And use of heat absorbing agent:**
This subclass is indented under subclass 39. Process in which a substance is added to the gaseous fluid mixture to prevent a material rise in temperature of the gaseous fluid mixture by absorbing the heat of compression.
- 41 And solid sorption:**
This subclass is indented under subclass 39. Process in which a solid sorbent is used to remove a constituent from the gaseous fluid mixture.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
90+, for processes of solid sorption without compressing and cooling of the gaseous fluid mixture in order to separate.
- 42 And liquid contact (e.g., scrubbing, sorption, etc.):**
This subclass is indented under subclass 39. Process in which a liquid is used to remove a constituent from the gaseous fluid mixture (e.g., scrubbing, sorption, etc.).
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
149+, for processes of liquid contact without compressing and cooling of the gaseous fluid mixture in order to separate.
- 43 SELECTIVE DIFFUSION OF GASES:**
This subclass is indented under the class definition. Process in which a fluid mixture containing a gas to be separated contacts a solid, liquid, or gaseous barrier, with the gas separating because of the differential permeability of the barrier with respect to the gas.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 4+ for apparatus for selective diffusion of gases.

44 Selective diffusion of gases through immobilized liquid:

This subclass is indented under subclass 43. Process in which a plurality of gases containing a gas to be separated contacts a liquid barrier that is supported or immobilized in or on a porous medium, with the plurality of gases being separated because of the differential permeability of the liquid with respect to the gases.

SEE OR SEARCH THIS CLASS, SUBCLASS:

149+, for processes of contacting a fluid mixture with a liquid.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 5 for corresponding apparatus. Patents are not cross-referenced from Class 96, subclass 5 to this subclass based only on disclosure. Therefore, relevant disclosures of gas separation processes may be found in the apparatus area.

45 Selective diffusion of gases through substantially solid barrier (e.g., semipermeable membrane, etc.):

This subclass is indented under subclass 43. Process in which a plurality of gases or a mixture of gas entrained in a liquid contacts a substantially solid surface (e.g., semipermeable membrane, etc.) and a gas is separated from another gas or a gas is separated from the liquid because of the differential permeability of the surface of the solid with respect to the gases.

- (1) Note. Class 95 will take dissociation of a gas molecule at the barrier boundary when such dissociation facilitates passage of the gas through the barrier; the atoms reconvert to the gas molecule on the downstream side of the barrier. If the dissociation of the gas occurs away from the barrier and a resulting product diffuses through the barrier, then the patent will be in Class 423 for an inorganic gas and in the appropriate organic class for an organic gas.

SEE OR SEARCH CLASS:

- 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 334+ for processes using a solid electrolyte membrane (SEM) situated between two electrodes positioned to apply external voltage across the membrane. These membranes are used where the partial pressure of the gas to be diffused through the membrane on the feed side of the membrane is lower than that on the permeate side. Molecules on the feed side of a cell containing a solid electrolyte membrane are electrochemically dissociated into ions on the cathode. The ions are then transported across the matrix of the membrane by the applied voltage and recombined to form molecules on the anode. Class 95 takes the use of a solid electrolyte membrane which functions without electrodes and without externally applied voltage. These membranes are used where the partial pressure of the gas to be diffused through the membrane on the permeate side is lower than that on the feed side. Electrodeless solid electrolyte membrane cells are operated by maintaining a pressure on the feed side such that a positive driving force for ion transport can be achieved in the absence of an externally applied voltage and power source.
- 210, Liquid Purification or Separation, subclass 96.2, 257.2, and 321.6+ for apparatus having membranes or dialyzers for separating liquids, subclasses 500.21+ for semipermeable membranes used in the separation of liquids, and subclasses 634+ for processes of separating a liquid by selective diffusion of a component of a liquid through a membrane or septum.
- 427, Coating Processes, subclasses 245+ for methods of coating a base so that the resulting product is foraminous or porous, wherein the coating includes openings or holes which are very small, generally microscopic in size.

- 520, Synthetic Resins or Natural Rubbers, for synthetic resins or natural rubbers that may be used for selective diffusion of gases.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 818+ for processes in which a liquid hydrocarbon is recovered from a liquid mixture containing the hydrocarbon by the use of selective diffusion through a semi-permeable membrane.
- 46 Degasification of liquid:**
This subclass is indented under subclass 45. Process in which gas is separated from a liquid by selective diffusion of the gas through a substantially solid barrier.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 30, for processes of degasification of a liquid by use of sound waves.
- 156+, for processes of contacting a gas with a liquid and degasification of the contact liquid.
- 241+, for other processes of degasification of a liquid.
- SEE OR SEARCH CLASS:
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclass 405 for processes of removing gas from liquid metal by use of a gas permeable membrane.
- 96, Gas Separation: Apparatus, subclass 6 for corresponding apparatus. Patents are not cross-referenced from Class 96, subclass 6 to this subclass based only on disclosure. Therefore, relevant disclosures of gas separation processes may be found in the apparatus area.
- 210, Liquid Purification or Separation, subclass 640 for processes of separating a constituent from a liquid by selective diffusion of the constituent through a membrane or septum wherein the constituent is not initially present as a gas in the liquid and passes through the membrane or septum in vapor phase.
- 47 Nitrogen or nitrogen containing compound permeates barrier:**
This subclass is indented under subclass 45. Process in which nitrogen (N₂) or a nitrogen containing compound selectively diffuses through a substantially solid barrier.
- 48 Halogen containing compound permeates barrier:**
This subclass is indented under subclass 45. Process in which a halogen (i.e., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) containing compound selectively diffuses through a substantially solid barrier.
- 49 Sulfur containing compound permeates barrier:**
This subclass is indented under subclass 45. Process in which a sulfur (S) containing compound selectively diffuses through a substantially solid barrier.
- 50 Organic compound permeates barrier:**
This subclass is indented under subclass 45. Process in which an organic compound selectively diffuses through a substantially solid barrier.
- 51 Carbon dioxide or carbon monoxide permeates barrier:**
This subclass is indented under subclass 45. Process in which carbon dioxide (CO₂) or carbon monoxide (CO) selectively diffuses through a substantially solid barrier.
- 52 Water vapor permeates barrier:**
This subclass is indented under subclass 45. Process in which water (H₂O) vapor selectively diffuses through a substantially solid barrier.
- 53 Helium permeates barrier:**
This subclass is indented under subclass 45. Process in which helium (He) selectively diffuses through a substantially solid barrier.
- 54 Oxygen permeates barrier:**
This subclass is indented under subclass 45. Process in which oxygen (O₂) selectively diffuses through a substantially solid barrier.

55 Hydrogen permeates barrier:

This subclass is indented under subclass 45. Process in which hydrogen (H₂) selectively diffuses through a substantially solid barrier.

56 Elemental metal or alloy barrier:

This subclass is indented under subclass 55. Process in which hydrogen (H₂) selectively diffuses through a substantially solid barrier that is made of elemental metal or alloy or contains a layer of elemental metal or alloy.

- (1) Note. The hydrogen (H₂) molecule may dissociate into hydrogen (H) atoms at the surface of the barrier. The atoms will then diffuse through the barrier and recombine into a hydrogen (H₂) molecule on the downstream side of the barrier.

SEE OR SEARCH CLASS:

- 210, Liquid Purification or Separation, subclass 500.25 for a metal-containing semipermeable membrane used in liquid separation.
- 423, Chemistry of Inorganic Compounds, subclass 658.2 for processes of producing elemental hydrogen (H) by direct decomposition of a binary compound (e.g., chemical storage, etc.).

57 ELECTRIC OR ELECTROSTATIC FIELD (E.G., ELECTROSTATIC PRECIPITATION, ETC.):

This subclass is indented under the class definition. Process in which an electric current is discharged into the fluid mixture or the fluid mixture is contacted with a fluid or solid which has been electrified.

- (1) Note. The separation of the fluid mixture need not be accomplished directly by the electrical treatment, provided that the overall process results in separation of the fluid mixture. The electrical treatment may be for the purpose of causing entrained particles to become agglomerated for easier removal by other means, such as filtration or deflection.
- (2) Note. Gas separation processes including the mere application of electricity to a

material contacting the fluid mixture for the purpose of resistance heating is classified below.

- (3) Note. Processes for separating isotopes are classified based upon the specific methods used (e.g., the separation of liquid isotopes by distillation is classified in Class 203, subclass 5; isotope separation involving chemical reaction brought about by wave energy is found in Class 204, subclasses 157.2+, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 2+, for processes involving an electric field with control responsive to sensed condition.
- 25, for processes involving an electric field with recording or signaling of a condition.
- 26, for processes involving an electric field with timing of an operation.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 15+ for apparatus using an electric field to separate gas constituents. Also, see other collected search class notes regarding related subject matter.
- 204, Chemistry: Electrical and Wave Energy, subclasses 164+ for processes involving gas treatment by chemical reaction and electrical discharge or chemical change by electrical discharge, and subclasses 554+ and 660+ for similar processes and apparatus for electrical separation or purification of liquids and for degasification of liquid aided by electrical discharge involving the conversion of constituents to other compounds. When such chemical conversion is in doubt, placement of electrical processes and apparatus for degasifying liquid is proper for Class 95 or Class 96, respectively.
- 209, Classifying, Separating, and Assorting Solids, subclass 12.2 for a combination process or apparatus of classifying, separating, and assorting solids including an electrostatic field; and subclasses 127.1+ for process and

- apparatus for classifying, separating, or assorting solids by an electrostatic field.
- 210, Liquid Purification or Separation, subclass 748 for processes of treating a liquid by directly subjecting the liquid to an electric field or a current or to a regular pulsating source of energy. Also, see the search class note to Class 204.
- 250, Radiant Energy, subclasses 282+ for methods of separating certain accelerated ionized material from similar accelerated ionized material having different mass-to-electric-charge ratios by use of electrostatic or magnetic fields.
- 58 With addition of solid, gas, or vapor:**
This subclass is indented under subclass 57. Process which includes adding a solid, gas, or vapor to the fluid mixture undergoing treatment or separation.
- (1) Note. To come under this definition, the added solid, gas, or vapor must not be merely a different amount of the same fluid mixture that is to be separated, but may be a constituent of this mixture, which may be derived from a previous separation process.
- (2) Note. The addition of solid includes the use of a fluidized solid particle bed, regardless of whether the solid remains entrained in the gas after passage through the bed. The use of a stationary particle bed is not considered to be addition of a solid, and patents in which a stationary particle bed is used will be found elsewhere under subclass 57. Also, for the purposes of this subclass, the added solid, gas, or vapor may include any combination thereof (except for a different amount of the fluid mixture to be separated, as in (1) Note), including aerosols.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclass 27 for means to add charged solid or liquid particles to the gas stream, subclass 52 for vapor or liquid contact apparatus involving electrical separation, and subclass 74 for gas separation apparatus including an electrical precipitator and means to treat or condition the gas before, during, or after precipitation.
- 59 Electrode treating (e.g., coating, cleaning, etc.):**
This subclass is indented under subclass 58. Process which includes the physical treatment of an electrode (e.g., by addition of a protective or reactive layer to the electrode or the removal of collected material from the electrode, etc.).
- SEE OR SEARCH THIS CLASS, SUBCLASS:
74+, for processes with cleaning of a collecting electrode but without the addition of a solid, gas, or vapor.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 28+ for electrical separation apparatus with electrode cleaner, apparatus part flusher or discharger, or wet collector.
- 60 Heating or cooling:**
This subclass is indented under subclass 58. Process in which the fluid mixture to be separated is heated or cooled either by or along with the addition of solid, gas, or vapor.
- 61 Solid is electrically conducting:**
This subclass is indented under subclass 58. Process in which a solid of low electrical resistance is added to the fluid mixture.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 28+ for electrical separation apparatus containing electrodes coated with a wet conductive film.
- 62 Agglomerating gas-borne particles:**
This subclass is indented under subclass 58. Process in which solid or liquid particles to be separated from a gas are agglomerated into larger conglomerates either in the gas phase or on a collecting surface, with the agglomeration being facilitated by addition of a solid, gas, or vapor to the incoming fluid mixture.

- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclass 77 for electrical separation apparatus containing electrical means for agglomerating particles.
- 63 And nonelectrical separation of fluid mixture:**
This subclass is indented under subclass 57. Process which includes methods of separation of the fluid mixture other than those explicitly connected with an electrical separation technique.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
74+, for processes involving the removal of material from a collecting electrode.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclass 27 for electrical separation apparatus with means to add charged liquid or solid particles to the gaseous fluid mixture, subclass 52 for electrical separation apparatus with means to add a liquid or vapor to the gaseous fluid mixture, and subclass 55 for electrical separation apparatus with serially arranged nonelectrical separators.
- 64 Liquid addition to gaseous fluid mixture:**
This subclass is indented under subclass 63. Process in which a liquid is added to a gaseous fluid mixture before, during, or after electrical treatment either (a) to cause separation or (b) to condition the gaseous fluid mixture in any way.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
75, for processes involving the removal of material from a collecting electrode by flushing with a liquid.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 52+ for electrical separation apparatus with vapor or liquid contact.
- 65 Liquid addition precedes electrical precipitation:**
This subclass is indented under subclass 64. Process in which liquid addition is made before the gaseous fluid mixture is subjected to electrical separation.
- 66 With heating or cooling:**
This subclass is indented under subclass 65. Process including heating or cooling either as a result of the liquid addition or as a separate, additional gas treatment.
- 67 By heating or cooling:**
This subclass is indented under subclass 63. Process in which nonelectrical gas separation is caused by heating or cooling a gaseous fluid mixture.
- 68 Including cleaning or regeneration of separating means (e.g., particulate bed filter, deflector, etc.):**
This subclass is indented under subclass 63. Process which includes removal of collected material from or regeneration of a nonelectrical gas separating means, such as a particulate bed filter or deflector.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
90+, for processes of solid sorption which may include regeneration of the solid sorbent.
276, for processes of cleaning a particulate filter bed.
278, for processes of cleaning a cohesive filter.
- SEE OR SEARCH CLASS:
55, Gas Separation, subclasses 282+ for gas separating apparatus with nonliquid cleaning means for separating media, and subclass 431 for means contacting an apparatus part with a fluid for discharge of material residue.
96, Gas Separation: Apparatus, subclass 228 for gas separation apparatus with means using liquid to clean the gas separation apparatus.

69 Distinct separation step precedes electric or electrostatic treatment:

This subclass is indented under subclass 63. Process in which at least one nonelectrical separating step is performed on the fluid mixture before electric or electrostatic treatment.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclasses 315+ for serial diverse separating media not including an electrical separation apparatus.
- 96, Gas Separation: Apparatus, subclasses 55+ for electrical separation apparatus with serially arranged diverse separators; in particular, subclass 57 for such apparatus preceded by a nonelectrical separator.

70 Distinct separation step follows electric or electrostatic treatment:

This subclass is indented under subclass 63. Process in which at least one nonelectrical separating step is performed on the fluid mixture after electric or electrostatic treatment.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclasses 315+ for serial diverse separating media not including electrical separation apparatus.
- 96, Gas Separation: Apparatus, subclasses 55+ for electrical separation apparatus with serially arranged diverse separators.

71 With addition of liquid to gaseous fluid mixture:

This subclass is indented under subclass 57. Process in which a liquid is added to a gaseous fluid mixture undergoing treatment, but does not directly result in the separation of gas constituents.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 64+, for processes involving contacting a gaseous fluid mixture with a liquid in a diverse type operation (in which gas constituents are also separated by nonelectrical methods, such as directly results from liquid addition).

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 52 for corresponding electrical field separation apparatus with means to add liquid or vapor to the gas and subclasses 243+ for gas separation apparatus with gas and liquid contact means.

72 Vaporization of liquid:

This subclass is indented under subclass 71. Process in which the added liquid is vaporized to join the gas phase.

73 With heating or cooling:

This subclass is indented under subclass 57. Process which includes heating or cooling of the fluid mixture being treated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 67, for related processes in which a nonelectrical gas separation is caused by heat exchange with the gas.

74 With cleaning of collector electrode:

This subclass is indented under subclass 57. Process which includes cleaning or removing of a deposited constituent from an electrical element provided to attract and retain the constituent.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 28+ for corresponding electrode cleaning means.
- 134, Cleaning and Liquid Contact With Solids, for cleaning matter from solid materials or objects.

75 By liquid flushing:

This subclass is indented under subclass 74. Process in which the cleaning of the element is performed by the application of a liquid stream.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 43+ for corresponding apparatus with fluid contacting means.

76 By scraping or vibrating:

This subclass is indented under subclass 74. Process in which the cleaning of the element is performed by the application of mechanical contacting or jarring means to remove retained material.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 32+ for corresponding apparatus with vibrating means, and subclass 51 for corresponding apparatus with scraping means.

77 Continuously moving electrode:

This subclass is indented under subclass 57. Process in which an element discharging electricity into the fluid mixture or collecting deposits therefrom continually moves during operation.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 39+ for electrical separation apparatus with movably mounted electrode assembly for cleaning purposes and subclass 94 for electrode supporting means permitting movement thereof during use or for orientation.

78 Including baffling, deflection, or restriction of gas flow:

This subclass is indented under subclass 57. Process in which a restriction or redirection of gas flow is caused by inclusion of a baffle, deflector, or specially shaped electrode for the purpose of such restriction.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 60+ for corresponding apparatus with gas flow distribution means, subclasses 95+ for apparatus with specific type or shape of discharge electrode, and subclasses 98+ for specific collector means.

79 Plural separate stages or zones (e.g., separate ionization and collection regions, etc.):

This subclass is indented under subclass 57. Process in which a gaseous fluid mixture passes through two or more distinct regions or

units, such regions providing either multiple identical gas treatments or plural diverse treatments for removal of entrained particles.

(1) Note. The stages or zones may be arranged in series or in parallel.

(2) Note. A single stage with two or more regions or zones of differing applied voltage is included under this definition.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

63+, for processes with nonelectrical gas separating steps.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 55+ for electrical separation apparatus with serial diverse separators and subclasses 75+ for electrical separation apparatus with diverse or serially distinct electrical fields.

80 Pulsing or time-varying electric field (e.g., AC, pulsed DC, etc.):

This subclass is indented under subclass 79. Process involving the application of a voltage which fluctuates with time during treatment of the gaseous fluid mixture.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 54 for electrical separation apparatus having an alternating current field.

81 Pulsing or time-varying electric field (e.g., AC, pulsed DC, etc.):

This subclass is indented under subclass 57. Process involving the application of a voltage which fluctuates with time during treatment of the gaseous fluid mixture.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 54 for electrical separation apparatus having an alternating current field.

82 CHROMATOGRAPHY:

This subclass is indented under the class definition. Process in which (a) the plurality of gases to be separated enters a column to contact a liquid, known as the "stationary liquid phase," supported by a base of solid material to succes-

sively sorb therein the different gases of the mixture or (b) the plurality of gases to be separated enters a column to contact a solid sorbent to successively sorb thereon the different gases of the mixture with or without subsequently successively eluting or displacing the sorbed gases in (a) or (b) with a gas which is inert with respect to the sorbed gases and sorbent; and subcombinations of the processes in (a) and (b) that do not result in separation when the subcombinations are not provided for elsewhere.

- (1) Note. The plurality of gases is usually allowed to flow slowly through a column of particulate sorbent. Different gases will pass at different speeds through the column and will eventually be separated into zones. The zones can be eluted by passing an inert gas through the column and collecting the various fractions.
- (2) Note. When a liquid is supported by a base of solid material for the separation of the mixture of gases, the process is known as "gas-liquid chromatography" or "GLC." If liquid is not present, the process is known as "gas-solid chromatography." Other phrases used when referring to chromatography are "gas-chromatography" or "GC," "vapor-phase chromatography" or "VPC," "gas-liquid partition chromatography," "vapor fractionometry," "capillary column gas chromatography" or "CC-GC," and "partition chromatography."
- (3) Note. Sometimes a "carrier" gas is mixed with or used to propel the plurality of gases to be separated through the chromatography column.
- (4) Note. The plurality of gases to be separated may be obtained by vaporizing a liquid. The liquid that is injected into the chromatography column is vaporized, and then the resulting vapors are separated in the chromatography column.

SEE OR SEARCH THIS CLASS, SUBCLASS:

245+, and 263+, for processes of separating gases from liquids by contacting the liquid with a gas.

SEE OR SEARCH CLASS:

- 73, Measuring and Testing, subclass 19.02, 23.22+, and 23.35+ for chromatography including analysis of eluted or displaced gas.
- 96, Gas Separation: Apparatus, subclasses 101+ for gas chromatography apparatus.
- 210, Liquid Purification or Separation, subclasses 656+ and 198.2+ for processes and apparatus of liquid purification or separation involving chromatography.
- 436, Chemistry: Analytical and Immunological Testing, subclasses 161+ for processes which involve a chemical reaction for analytical testing including chromatography and for processes of analysis of the chemical properties of a sample including chromatography.

83 Liquid supported on surface of capillary column:

This subclass is indented under subclass 82. Process in which the base of solid material supporting the stationary liquid phase as a thin film is the inner surface of a capillary tube or column.

84 Liquid supported on particulate packing:

This subclass is indented under subclass 82. Process in which the base of solid material supporting the stationary liquid phase is a granular solid.

85 Including use of gas flow distributor in column:

This subclass is indented under subclass 82. Process in which gas is directed or channelled by use of a deflector inside the column.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 107 for corresponding apparatus. Patents are not cross-referenced from Class 96, subclass 107 to this subclass based only on disclosure. Therefore, relevant disclosures to gas separation processes may be found in the apparatus area.

86 Plural separate columns:

This subclass is indented under subclass 82. Process in which the plurality of gases passes through two or more parallel or serial columns.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 104 for chromatographic apparatus having two or more separate and distinct stages or zones.

87 With heating or cooling:

This subclass is indented under subclass 82. Process in which the plurality of gases, a liquid, a separated constituent, or an apparatus involved in the process is heated or cooled (e.g., the column may be heated in order to degas the solid sorbent or a gas may be heated or cooled, etc.).

88 Specific column packing or sorbent material (e.g., particle size, composition, etc.):

This subclass is indented under subclass 82. Process in which a specified packing or sorbent material (e.g., sorbent compositions, particle size, etc.) is used.

89 Injection, per se, without separation:

This subclass is indented under subclass 82. Process in which a method of injecting the plurality of gases or a liquid into the chromatography column is claimed, per se, without gas separation.

SEE OR SEARCH CLASS:

141, Fluent Material Handling, With Receiver or Receiver Coating Means, for processes and apparatus for the transfer of fluent material through a flow confining system, the source and receiver parts of which are normally separable.

90 SOLID SORPTION:

This subclass is indented under the class definition. Process in which a solid sorbent is used to retain on its internal or external surfaces a constituent of the fluid mixture passing in contact therewith.

- (1) Note. A solid sorbent is a solid material which separates a constituent (e.g., a gas, vapor, etc.) from a fluid mixture contain-

ing such constituents in a “quasi-chemical” manner. The action in most instances is that of selective retention (i.e., the sorbent removes only the part of the fluid mixture for which it has the greatest affinity). The retained constituent cannot be removed by shaking, brushing, or similar mechanical action, but generally can be removed by heating, pressure reduction, or use of a stripping or denuding fluid. A filter (particulate solids or other) has no particular “chemical” affinity for a constituent of a fluid mixture. The separation in the case of a filter depends on a mechanical entrapment of solid or liquid particles because of their relatively large size compared with the interstices or spaces between individual elements of the filter. The retained particles can be removed by brushing, wiping, shaking, or similar mechanical action.

- (2) Note. “Absorption” is the holding of a constituent by cohesion or capillary action in the pores of a solid. “Adsorption” is the ability of a sorbent to hold or concentrate gases, liquids, or dissolved substances upon its surface.
- (3) Note. The desorption of a solid sorbent, which may appear in one of the subclasses below, must be before or after its use as a sorbent, as claimed. The mere treatment of a solid sorbent to drive off the fluid sorbed thereon or therein is proper subject matter for Class 502. See search class note below.
- (4) Note. This subclass and the subclasses indented hereunder will take the degasification of a liquid by use of a solid sorbent.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 41, for processes using compressing and cooling of a fluid mixture to separate a constituent from the mixture in addition to using a solid sorbent to separate a constituent from the gas.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 108+ for apparatus containing solid sorbents.
- 203, Distillation: Processes, Separatory, subclass 41 for a separatory distillation process including the step of passing the produced vapor through a solid sorbent.
- 210, Liquid Purification or Separation, subclasses 660+ for processes of using a solid sorbent to purify or separate a liquid.
- 420, Alloys or Metallic Compositions, subclass 900 for hydrogen (H₂) storage alloys or metallic compositions.
- 423, Chemistry of Inorganic Compounds, subclass 658.2 for processes of producing elemental hydrogen (H) by direct decomposition of a binary compound (e.g., chemical storage, etc.).
- 436, Chemistry: Analytical and Immunological Testing, subclass 167 for processes wherein the basis for analysis is an optical result of a chemical reaction that is measured mechanically or visually, including solid sorption of a gas.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, subclasses 20+ for regenerating or rehabilitating solid sorbent compositions, per se, subclasses 60+ for zeolite compositions and for processes of making zeolite compositions, and subclasses 400+ for other solid sorbent compositions and for processes of making solid sorbent compositions. Class 95 will take the combination of gas separation using a solid sorbent composition and regenerating or rehabilitating the solid sorbent composition.
- 585, Chemistry of Hydrocarbon Compounds, subclasses 820+ for processes in which a mixture of a hydrocarbon compound with another substance is treated to recover that same compound in a more usable condition, that is, a purer or more desirable condition, by a treatment which comprises separating the hydrocar-

bon from the other substance by contact with a solid sorbent.

91

Soluble or deliquescent material used:

This subclass is indented under subclass 90. Process in which the solid sorbent dissolves in the constituent retained or sorbed therein or thereon.

- (1) Note. The resultant solution may be used in a liquid contacting zone to aid in the separation.
- (2) Note. A deliquescent material is a water-soluble chemical salt used to sorb atmospheric water vapor.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 118+ for apparatus containing a soluble or deliquescent sorbent material.

92

And liquid contact (e.g., scrubbing, sorption, etc.):

This subclass is indented under subclass 90. Process in which a gaseous fluid mixture is contacted by a liquid in addition to a solid sorbent in order to remove a gas, solid, or liquid therefrom.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 36+, for processes in which a liquid-solid slurry is used to cause gas separation.

93

Sweep gas used on solid sorbent:

This subclass is indented under subclass 92. Process in which a gas is used to purge the constituent separated from the solid sorbent or a gas is used to regenerate the solid sorbent.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 97+, and 104+, for processes of using a sweep gas on a solid sorbent including reduction of pressure.

94

And recycle or reuse of contact liquid for further contact:

This subclass is indented under subclass 92. Process in which (a) the contact liquid is recirculated for further contact with the fluid mixture or a portion thereof or (b) the contact

- liquid is used in another step of the process for further contact with the fluid mixture or a portion thereof.
- 95 Including reduction of pressure:**
This subclass is indented under subclass 90. Process in which pressure over a mass of solid sorbent is decreased in order to separate from the solid sorbent the constituent sorbed in the gas separation process.
- 96 Plural pressure varying steps (e.g., pressure swing adsorption, etc.):**
This subclass is indented under subclass 95. Process in which there is more than one step of increasing or decreasing the pressure on the solid sorbent.
- 97 Sweep gas used:**
This subclass is indented under subclass 96. Process in which a gas is used to purge the constituent separated from the solid sorbent or a gas is used to regenerate the solid sorbent.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
93, for processes of solid sorption and liquid contact including use of a sweep gas on a solid sorbent.
104+, for processes in which a sweep gas is used to carry desorbed gas without the use of plural pressure varying.
- 98 Feed gas or constituent thereof is sweep gas:**
This subclass is indented under subclass 97. Process in which the sweep gas is the gaseous fluid mixture or a portion thereof, before or after being treated or separated.
- 99 With heating or cooling:**
This subclass is indented under subclass 98. Process in which the solid sorbent or a gas is heated or cooled.
- 100 Stepped pressure reduction:**
This subclass is indented under subclass 98. Process in which the pressure over the solid sorbent is decreased in more than one step.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
103, for processes in which there is use of pressure reduction in more than one
- step without the use of a sweep gas to carry desorbed gas.
- 101 Vacuum applied:**
This subclass is indented under subclass 100. Process in which a step of pressure reduction is accomplished by using a pressure below that of the atmosphere.
- 102 Vacuum applied:**
This subclass is indented under subclass 98. Process in which a step of pressure reduction is accomplished by using a pressure below that of the atmosphere.
- 103 Stepped pressure reduction:**
This subclass is indented under subclass 96. Process in which the pressure over the solid sorbent is decreased in more than one step.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
100, for processes in which there is use of pressure reduction in more than one step with the use of a sweep gas to carry desorbed gas.
- 104 Sweep gas used:**
This subclass is indented under subclass 95. Process in which a gas is used to purge the constituent separated from the sorbent or a gas is used to regenerate the solid sorbent.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
93, for processes of solid sorption and liquid contact including use of a sweep gas on a solid sorbent.
97+, for processes in which a sweep gas is used to carry desorbed gas with the use of plural pressure varying.
- 105 Feed gas or constituent thereof is sweep gas:**
This subclass is indented under subclass 104. Process in which the sweep gas is the gaseous fluid mixture or a portion thereof, before or after being treated or separated.
- 106 With heating or cooling:**
This subclass is indented under subclass 95. Process in which the solid sorbent or a gas is heated or cooled.

107 Moving sorbent:

This subclass is indented under subclass 90. Process in which the solid sorbent is moved from one zone to another by moving a housing, is moved from one zone to another in a stationary housing, or is blown about or fluidized by a gas in a housing.

- (1) Note. The zones need not all be for sorbing the gas or for desorbing the solid sorbent; it is sufficient that the solid sorbent be moved from one zone to another, in each of which zones the solid sorbent either is treated or is used to treat.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 150 for apparatus having a moving solid sorbent.

108 Fluidized bed:

This subclass is indented under subclass 107. Process in which the solid sorbent is blown about or fluidized by a gas in a housing.

109 Having gravity flow of sorbent from zone to zone:

This subclass is indented under subclass 108. Process in which the solid sorbent is moved from one zone to another in a stationary housing by the forces of gravity.

110 Gravity flow of sorbent from zone to zone:

This subclass is indented under subclass 107. Process in which the solid sorbent is moved from one zone to another in a stationary housing by the forces of gravity.

111 Sweep gas used:

This subclass is indented under subclass 110. Process in which a gas is used to purge a constituent separated from the solid sorbent or a gas is used to regenerate the solid sorbent.

112 Steam is sweep gas:

This subclass is indented under subclass 111. Process in which the sweep gas is steam.

113 Rotating housing containing fixed sorbent or rotating plurality of housings:

This subclass is indented under subclass 107. Process in which the housing containing a fixed solid sorbent turns on its axis in order to

move the solid sorbent from one treatment zone to another or a plurality of housings is turned about a central axis to the housings to place a housing in a position of use or nonuse or regeneration.

114 With plural indirect heat transfer steps on solid sorbent or gaseous fluid mixture or constituent thereof:

This subclass is indented under subclass 90. Process in which there is more than one step of heating or cooling the solid sorbent or the gaseous fluid mixture or constituent thereof through a wall before or after separation.

- (1) Note. The heat transfer steps must be part of a larger process containing subject matter for Class 95, such as will be found in this and the indented subclass where the heat transfer steps are combined with sorption of a constituent from a gas on a solid sorbent. If the only separation involved is conducted by the heat transfer steps, then classification in Class 165 is proper.

SEE OR SEARCH CLASS:

165, Heat Exchange, appropriate subclasses for processes where only indirect heat exchange causes the separation of a constituent from a gas.

115 Heating and cooling:

This subclass is indented under subclass 114. Process in which there is heating and cooling of the solid sorbent or of a gas.

SEE OR SEARCH CLASS:

165, Heat Exchange, subclasses 58+ and 201+ for processes of heating and cooling where only the indirect heat exchange causes the separation of a constituent from a gas.

116 Inorganic gas or liquid particle sorbed (e.g., vapor, mist, etc.):

This subclass is indented under subclass 90. Process in which an inorganic gas or liquid particle (e.g., vapor, mist, etc.) is sorbed from the plurality of gases or the gas with entrained liquid particles.

- (1) Note. For purposes of classification in this area, "inorganic" compounds or ele-

- ments are those that would fall within the definition of Class 423. For example, the cyanides (CN joined only to a metal or to hydrogen) and the carbon oxides are found in the indented subclasses.
- 117 Water sorbed:**
This subclass is indented under subclass 116. Process in which water is sorbed from the plurality of gases or the gas with entrained liquid particles.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
91, for processes in which water-soluble chemical salts are used to sorb atmospheric water vapor.
- 118 Plural separating treatments of gas by solid sorbent to remove water:**
This subclass is indented under subclass 117. Process in which the gas is passed through a plurality of discrete or diverse separating stages or steps, with the solid sorbent being the same or a different solid sorbent in each step of the process.
- 119 And regeneration of any solid sorbent:**
This subclass is indented under subclass 118. Process in which at least one of the solid sorbents is revived or regenerated.
- 120 Heating or cooling:**
This subclass is indented under subclass 119. Process in which the solid sorbent or a gas is heated or cooled.
- 121 And regeneration of solid sorbent:**
This subclass is indented under subclass 117. Process in which the solid sorbent is revived or regenerated.
- 122 Sweep gas used:**
This subclass is indented under subclass 121. Process in which a gas is used to purge the water separated from the solid sorbent or a gas is used to regenerate the solid sorbent.
- 123 Hot sweep gas:**
This subclass is indented under subclass 122. Process in which there is a positive step of raising the temperature of the sweep gas above the ambient temperature or the sweep gas is already at a temperature above the ambient temperature.
- 124 And cooling of sweep gas:**
This subclass is indented under subclass 123. Process in which the sweep gas is cooled.
- 125 And cooling of solid sorbent:**
This subclass is indented under subclass 123. Process in which the solid sorbent is cooled.
- 126 By heating:**
This subclass is indented under subclass 121. Process in which the solid sorbent is revived or regenerated by heating.
- 127 Noble gas sorbed:**
This subclass is indented under subclass 116. Process in which a noble gas (i.e., helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), or radon (Rn)) is sorbed.
- 128 Nitrogen containing compound sorbed:**
This subclass is indented under subclass 116. Process in which a nitrogen containing compound is sorbed.
- 129 Nitrogen oxide sorbed:**
This subclass is indented under subclass 128. Process in which a nitrogen oxide (e.g., nitric oxide (NO), nitrogen dioxide (NO₂), etc.) is sorbed.
- 130 Nitrogen sorbed:**
This subclass is indented under subclass 116. Process in which nitrogen (N₂) is sorbed.
- 131 Halogen or halogen containing compound sorbed:**
This subclass is indented under subclass 116. Process in which a halogen (i.e., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) or a halogen containing compound is sorbed.
- 132 Chlorine or chlorine containing compound sorbed:**
This subclass is indented under subclass 131. Process in which chlorine (Cl) or a chlorine containing compound is sorbed.

133 Metal or metal containing compound sorbed:

This subclass is indented under subclass 116. Process in which a metal or metal containing compound is sorbed.

- (1) Note. Arsenic (As) is considered to be a metal.

134 Mercury sorbed:

This subclass is indented under subclass 133. Process in which mercury (Hg) is sorbed.

135 Sulfur containing compound sorbed:

This subclass is indented under subclass 116. Process in which a sulfur (S) containing compound is sorbed.

136 Hydrogen sulfide sorbed:

This subclass is indented under subclass 135. Process in which hydrogen sulfide (H₂S) is sorbed.

137 Sulfur dioxide or sulfur trioxide sorbed:

This subclass is indented under subclass 135. Process in which sulfur dioxide (SO₂) or sulfur trioxide (SO₃) is sorbed.

138 Oxygen or ozone sorbed:

This subclass is indented under subclass 116. Process in which oxygen (O₂) or ozone (O₃) is sorbed.

139 Carbon dioxide sorbed:

This subclass is indented under subclass 116. Process in which carbon dioxide (CO₂) is sorbed.

140 Carbon monoxide sorbed:

This subclass is indented under subclass 116. Process in which carbon monoxide (CO) is sorbed.

141 Organic gas or liquid particle sorbed (e.g., vapor, mist, etc.):

This subclass is indented under subclass 90. Process in which an organic gas or liquid particle (e.g., vapor, mist, etc.) is sorbed from the plurality of gases or the gas with entrained liquid particles.

- (1) Note. For purposes of classification in this area, "organic" compounds are those that would fall within the definitions of Class 260.

142 Halogen containing compound sorbed (e.g., phosgene, etc.):

This subclass is indented under subclass 141. Process in which a halogen containing (i.e., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) compound (e.g., phosgene, etc.) is sorbed.

143 Hydrocarbon sorbed:

This subclass is indented under subclass 141. Process in which a hydrocarbon is sorbed.

144 Alkene sorbed:

This subclass is indented under subclass 143. Process in which an alkene (i.e., olefin) is sorbed.

145 Alkyne sorbed (e.g., acetylene, etc.):

This subclass is indented under subclass 143. Process in which an alkyne (i.e., alkine) is sorbed (e.g., acetylene, etc.).

146 Gasoline sorbed:

This subclass is indented under subclass 143. Process in which gasoline is sorbed.

147 Benzene ring containing compound sorbed:

This subclass is indented under subclass 143. Process in which a benzene ring containing compound is sorbed.

148 And regeneration:

This subclass is indented under subclass 90. Process in which the solid sorbent is revived or regenerated.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 95+, for processes of regeneration of the solid sorbent including the reduction of pressure.
107+, for processes of regeneration of the solid sorbent including the use of a moving sorbent.
114+, for processes of regeneration of the solid sorbent including plural indirect heat transfer steps.

116+, and 141+, for processes of regeneration of the solid sorbent including the sorption of a specifically named compound.

149 LIQUID CONTACTING (E.G., SORPTION, SCRUBBING, ETC.):

This subclass is indented under the class definition. Process in which the fluid mixture is contacted with a liquid.

- (1) Note. The contact of the fluid mixture with a liquid generally results in separation of a gas, solid particles, or liquid particles from a gaseous fluid mixture (e.g., sorption, scrubbing, etc.). The contact of the fluid mixture with a liquid does not have to cause separation of the mixture, however, but may be used for other reasons (e.g., to humidify a gas, etc.). As long as there is separation of the fluid mixture by some process of this class along with the contacting of the mixture with a liquid for reasons other than separation, the patent will be placed here (e.g., filtration plus humidification, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 44, for selective diffusion of gases through an immobilized liquid.
64+, and 71+, for electric or electrostatic field processes combined with liquid addition to the gas.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 243+ for gas separation apparatus using gas and liquid contact means combined with means to further handle the process constituents before, during, or after separation. See the class line to Class 261 in section III of this class for further details about gas and liquid contact apparatus and processes.
261, Gas and Liquid Contact Apparatus, for gas and liquid contact apparatus, per se, with or without separation, and for gas and liquid contact processes, per se, without separation (e.g., humidification, etc.). See the class line to Class 261 in section III of this

class for further details about gas and liquid contact apparatus and processes.

- 436, Chemistry: Analytical and Immunological Testing, subclass 168 for processes wherein the basis for analysis is an optical result of a chemical reaction that is measured mechanically or visually, including liquid sorption of a gas.
585, Chemistry of Hydrocarbon Compounds, subclasses 833+ for processes in which a mixture of a hydrocarbon compound with another substance is treated to recover that same compound in a more usable condition, that is, a purer or more desirable condition, by a treatment which comprises separating the hydrocarbon from the other substance by addition of an extraneous agent (e.g., solvent, etc.).

150 Including foaming of liquid to aid in the separation:

This subclass is indented under subclass 149. Process in which a frothy or sudslake dispersion of gas in the contact liquid is formed to aid in the separation.

- (1) Note. When foam is intentionally formed, it will be assumed to aid in the separation unless otherwise stated.

SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, appropriate subclasses for colloid systems or agents for such systems or making or stabilizing such systems or agents (subclasses 10+ for foaming), appropriate subclasses for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of colloid systems (subclasses 115+ for defoaming); in each instance, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

151 Mechanical agitation of liquid body to contact gaseous fluid mixture:

This subclass is indented under subclass 149. Process in which the gaseous fluid mixture is contacted with the liquid by mechanically stirring a liquid body or mass or by mechanically disturbing the surface of a liquid body or mass in such a way that the liquid is flung into the mixture.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 150, for processes in which agitation of the liquid body causes foaming of the liquid.
- 185, for processes of contacting a fluid mixture with a liquid combined with mechanical agitating in order to degasify the liquid.
- 260, for processes of degasification of a liquid by agitating.

152 Coagulating or flocculating agent:

This subclass is indented under subclass 149. Process in which solid particles are removed from a gas by a contact liquid that contains an agent that causes the solid particles to agglomerate.

- (1) Note. These agents are known as “coagulating” agents, “flocculating” agents, or “flocculent” materials.

SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 98+ for colloid systems of continuous or semicontinuous solid phase with discontinuous liquid phase (gels, pastes, flocs, coagulates) or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

153 Hydrate inhibitor:

This subclass is indented under subclass 149. Process in which the contact liquid contains an agent that prevents formation of a substance containing water combined in the molecular

form (e.g., agent prevents formation of methane hydrate: $\text{CH}_4\cdot 7\text{H}_2\text{O}$, ethane hydrate: $\text{C}_2\text{H}_6\cdot 8\text{H}_2\text{O}$, chlorine hydrate: $\text{Cl}_2\cdot 8\text{H}_2\text{O}$, etc.).

154 Surfactant or wetting agent:

This subclass is indented under subclass 149. Process in which the contact liquid contains an agent that reduces the surface tension of the contact liquid.

- (1) Note. These agents are known as “surfactants,” “wetting” agents, or “surface-active” substances.

155 Defoaming or antifoaming agent:

This subclass is indented under subclass 149. Process in which the contact liquid contains an agent that either (a) resolves or breaks a frothy or sudslike dispersion that was formed during the liquid-gas contact into separate fluid phases or (b) prevents formation of a frothy or sudslike dispersion during the liquid-gas contact.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 157, and 242, for other processes of defoaming a liquid.

SEE OR SEARCH CLASS:

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 115+ for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of foam colloid systems, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

156 And degasification of a liquid:

This subclass is indented under subclass 149. Process in which a gas is removed from a liquid.

- (1) Note. Generally, the patents in this subclass and the subclasses indented hereunder involve contacting a plurality of gases, with or without solid or liquid particles entrained therein, with a liquid in order to sorb or remove a gas or gases from the plurality of gases, allowing the

remaining gas or gases to pass out of contact with the liquid. The liquid with gas entrained therein then is treated to remove the sorbed gas. The removal may be for regenerating the liquid for further use or may be for obtaining the sorbed gas. In addition, this area takes processes in which the degasification of a liquid occurs first and the removed gas is subjected to a liquid contacting step (see subclass 158).

- (2) Note. In order for a patent to be placed here, the gas sorbed by a liquid from a plurality of gases and removed from the liquid must be normally gaseous at a temperature of 0°C and a pressure of 760 mm Hg (e.g., hydrogen sulfide (H₂S), carbon monoxide (CO), carbon dioxide (CO₂), ethane (C₂H₆), ammonia (NH₃), etc.). If, however, a constituent is at a temperature above its boiling temperature for a particular pressure, then the constituent is presumed to be a gas and the patent is placed here when the constituent is sorbed as a gas by a liquid, remains in gaseous phase in the liquid, and is removed from the liquid as a gas. The C₄ hydrocarbons, which have boiling points above and below a temperature of 0°C, are classified according to their individual boiling points in subclasses 149+ (e.g., butane with a boiling point of -0.5°C at 760 mm Hg pressure is a gas at a temperature of 0°C and 760 mm Hg pressure; whereas 1,2-butadiene with a boiling point of 10.8°C at 760 mm Hg pressure is a liquid at a temperature of 0°C and 760 mm Hg pressure). This handling of the C₄ hydrocarbons is in contrast to that of Class 203, in which all of the C₄ hydrocarbons are arbitrarily classified as liquids at a temperature of 0°C and 760 mm Hg pressure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 30, for processes of degasification of a liquid by use of sound waves.
46, for processes of degasification of a liquid by selective diffusion of gases through a substantially solid barrier.

- 188+, and 206+, for removal of a liquid from the contact liquid.
241+, for processes of degasification of a liquid without liquid contacting.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 155+ for degasifying means for liquid.

157

Defoaming:

This subclass is indented under subclass 156. Process in which a frothy or sudslike dispersion that was formed during the liquid-gas contact or was present before the liquid-gas contact is resolved or broken into separate fluid phases.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 155, and 242, for other processes of defoaming a liquid.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 176+ for defoaming apparatus.
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 115+ for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of foam colloid systems, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

158

Degasification step occurs first, with removed gas subsequently contacted by liquid:

This subclass is indented under subclass 156. Process in which a liquid with gas entrained therein is degassed and the removed gas is then contacted with a liquid.

159

By stripping with gas:

This subclass is indented under subclass 156. Process in which the gas is removed from the contact liquid by passing a gas through or in contact with the contact liquid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 83, and 84, for processes of eluting or displacing separated constituents from a chromatographic column comprising a liquid solvent on a solid base.
- 191, and 207, for separation of liquid from contact liquid by stripping with gas.
- 245+, for plural successive liquid degassing treatments which include stripping with gas.
- 263+, for degasification of liquid by stripping with gas.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 202+ for degasifying means for liquid with gas contacting means.

160 And reduction of pressure (e.g., flashing, etc.):

This subclass is indented under subclass 159. Process in which the pressure acting on the contact liquid is decreased.

- (1) Note. The pressure reduction may be used in a separate step in order to remove gas from the contact liquid in addition to the step of removing gas from the contact liquid by stripping with gas, or the pressure reduction may be used in order to aid the removal by stripping with gas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 172+, for liquid contacting and degasification of liquid by reduction of pressure.
- 247+, for plural successive liquid degassing treatments which include reduction of pressure.
- 266, for degasification of liquid by reduction of pressure.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 193+ for degasifying means for liquid of the pressure reducing type.

161 And heating:

This subclass is indented under subclass 160. Process in which the contact liquid or a gas is heated.

- (1) Note. The heating may be used in a separate step in order to remove gas from the contact liquid in addition to another step of removing gas from the contact liquid, or the heating may be used in order to aid the removal by stripping with gas or by reduction of pressure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 165+, for liquid contacting and degasification of liquid by stripping with gas combined with heating.
- 173+, for liquid contacting and degasification of liquid by reduction of pressure combined with heating.
- 178+, for liquid contacting and degasification of liquid by heating.
- 251+, for plural successive liquid degassing treatments which include heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

162 Steam is stripping gas:

This subclass is indented under subclass 161. Process in which the stripping gas is steam.

163 Liquid recycled or reused:

This subclass is indented under subclass 160. Process in which (a) the contact liquid is recirculated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

164 Feed gas or constituent thereof is stripping gas:

This subclass is indented under subclass 160. Process in which the stripping gas is the gaseous fluid mixture or a portion thereof, before or after being treated or separated.

165 And heating:

This subclass is indented under subclass 159. Process in which the contact liquid or a gas is heated.

- (1) Note. The heating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by stripping with gas, or the heating may be used in order to aid the removal by stripping with gas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 161+, for liquid contacting and degasification of liquid by stripping with gas combined with reduction of pressure and heating.
 173+, for liquid contacting and degasification of liquid by reduction of pressure combined with heating.
 178+, for liquid contacting and degasification of liquid by heating.
 251+, for plural successive liquid degassing treatments which include heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

166 Liquid recycled or reused:

This subclass is indented under subclass 165. Process in which (a) the contact liquid is circulated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

167 Vaporized component of contact liquid is stripping gas:

This subclass is indented under subclass 165. Process in which a constituent of the contact liquid is gasified and this constituent removes another gas from the contact liquid.

168 Steam is stripping gas:

This subclass is indented under subclass 165. Process in which the stripping gas is steam.

169 Liquid recycled or reused:

This subclass is indented under subclass 159. Process in which (a) the contact liquid is circulated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

170 Air is stripping gas:

This subclass is indented under subclass 159. Process in which the stripping gas is air.

171 Inert stripping gas:

This subclass is indented under subclass 159. Process in which the stripping gas is specified as being inert or is one of the following gases: helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), radon (Rn), nitrogen (N₂), or carbon dioxide (CO₂).

172 By reduction of pressure (e.g., flashing, etc.):

This subclass is indented under subclass 156. Process in which the gas is removed from the contact liquid by decreasing the pressure acting on the contact liquid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 160+, for processes of liquid contacting and degasification of liquid by stripping with gas in which there is reduction of pressure.
 192, and 208, for separation of liquid from contact liquid by reduction of pressure.
 247+, for plural successive liquid degassing treatments which include reduction of pressure.
 266, for degasification of liquid by reduction of pressure.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 193+ for degasifying means for liquid of the pressure reducing type.

173 And heating:

This subclass is indented under subclass 172. Process in which the contact liquid or a gas is heated.

- (1) Note. The heating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by reduction of pressure, or the heating may be used in order to aid the removal by reduction of pressure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 161+, for liquid contacting and degasification of liquid by stripping with gas combined with reduction of pressure and heating.
- 165+, for liquid contacting and degasification of liquid by stripping with gas combined with heating.
- 178+, for liquid contacting and degasification of liquid by heating.
- 251+, for plural successive liquid degassing treatments which include heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

174 Liquid recycled or reused:

This subclass is indented under subclass 173. Process in which (a) the contact liquid is recirculated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

175 Vacuum applied:

This subclass is indented under subclass 172. Process in which the step of pressure reduction is accomplished by using a pressure below that of the atmosphere.

176 Removed gas recycled:

This subclass is indented under subclass 172. Process in which the gas removed from the contact liquid is recirculated to the fluid mixture for further contact with liquid.

177 Liquid recycled or reused:

This subclass is indented under subclass 172. Process in which (a) the contact liquid is recirculated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

178 By heating:

This subclass is indented under subclass 156. Process in which the gas is removed from the contact liquid by heating.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 161+, for liquid contacting and degasification of liquid by stripping with gas combined with reduction of pressure and heating.
- 165+, for liquid contacting and degasification of liquid by stripping with gas combined with heating.
- 173+, for liquid contacting and degasification of liquid by reduction of pressure combined with heating.
- 193, and 209, for separation of liquid from contact liquid by heating.
- 251+, for plural successive liquid degassing treatments which include heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

179 Liquid recycled or reused:

This subclass is indented under subclass 178. Process in which (a) the contact liquid is recirculated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.

180 Liquid cooling step before being recycled:

This subclass is indented under subclass 179. Process in which there is a step of lowering the temperature of the liquid before it is recycled.

181 Sulfur compound removed:

This subclass is indented under subclass 178. Process in which a gaseous sulfur (S) compound is sorbed by the contact liquid and then is removed from the contact liquid by heating.

182 Halogen compound removed:

This subclass is indented under subclass 178. Process in which a gaseous halogen compound (i.e., a compound with fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) is sorbed by the contact liquid and then is removed from the contact liquid by heating.

183 Carbon dioxide removed:

This subclass is indented under subclass 178. Process in which carbon dioxide (CO₂) is sorbed by the contact liquid and then is removed from the contact liquid by heating.

- 184 Organic compound removed:**
This subclass is indented under subclass 178. Process in which a gaseous organic compound is sorbed by the contact liquid and then is removed from the contact liquid by heating.
- 185 By liquid flow modifying or mechanical agitating:**
This subclass is indented under subclass 156. Process in which the gas is removed from the contact liquid by mixing, stirring, or turbulating by contact with a solid member or the flow path of the contact liquid is altered.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
260+, for degasifying liquid by liquid flow modifying or mechanical agitating.
- 186 Liquid recycled or reused:**
This subclass is indented under subclass 156. Process in which (a) the contact liquid is circulated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process.
- 187 And recycle or reuse of contact liquid for further contact:**
This subclass is indented under subclass 149. Process in which (a) the contact liquid is circulated for further contact with the fluid mixture or a portion thereof or (b) the contact liquid is used in another step of the process for further contact with the fluid mixture or a portion thereof.
- (1) Note. The recycled or reused contact liquid may have been regenerated or it may be a mixture with the removed constituent.
- 188 After separation of liquid from contact liquid:**
This subclass is indented under subclass 187. Process in which the contact liquid is recycled or reused after another liquid constituent is removed from the contact liquid.
- (1) Note. The liquid removed from the contact liquid may have been originally present as liquid particles entrained in a gas, or the liquid removed may have been originally present as vapors as part of a plurality of gases, in which case the vapors would have condensed to liquid because of the liquid contact.
- (2) Note. In order for a patent to be placed here, the vapors sorbed by a liquid from a plurality of gases and removed from the liquid must be normally liquid at a temperature of 0°C and a pressure of 760 mm Hg and the vapors must have condensed to liquid (e.g., methanol (CH₃OH), ethanol (C₂H₅OH), etc.).
- SEE OR SEARCH THIS CLASS, SUBCLASS:
156+, for liquid contact and removal of a gas from a liquid.
206+, for separation of a liquid constituent from the contact liquid without recycling or reusing the contact liquid.
- 189 And separation of solid from contact liquid:**
This subclass is indented under subclass 188. Process in which a solid is removed from the contact liquid.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
195, and 205, for other processes of separating a solid from the contact liquid.
- 190 By liquid-liquid extraction or formation of azeotrope:**
This subclass is indented under subclass 188. Process in which (a) a liquid extractant is mixed with the contact liquid in order to cause separation of a solute from the contact liquid and then the liquid extractant with the removed solute is separated from the contact liquid or (b) a compound that forms a mixture of constant boiling point with a solute in the contact liquid is added to the contact liquid and then the azeotropic mixture is separated from the contact liquid.
- SEE OR SEARCH CLASS:
210, Liquid Purification or Separation, subclass 634 for processes, per se, in which a dissolved or suspended constituent of a liquid is preferentially dissolved or dispersed into a second liquid.

191 By stripping with gas:

This subclass is indented under subclass 188. Process in which the liquid constituent is removed from the contact liquid by passing a gas through or in contact with the contact liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 159+, for liquid contacting and degasification of liquid by stripping with gas.
- 207, for liquid contacting and separation of a liquid constituent from the contact liquid by stripping with gas without recycle or reuse of the contact liquid.

192 By reduction of pressure (e.g., flashing, etc.):

This subclass is indented under subclass 188. Process in which the liquid constituent is removed from the contact liquid by decreasing the pressure acting on the contact liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 172+, for liquid contacting and degasification of liquid by reduction of pressure.
- 208, for liquid contacting and separation of a liquid constituent from the contact liquid by reduction of pressure without recycle or reuse of the contact liquid.

193 By heating (e.g., fractional distillation, etc.):

This subclass is indented under subclass 188. Process in which the liquid constituent is removed from the contact liquid by heating the contact liquid (e.g., fractional distillation, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 178+, for liquid contacting and degasification of liquid by heating.
- 209, for liquid contacting and separation of a liquid constituent from the contact liquid by heating without recycle or reuse of the contact liquid.

194 Indirect heat exchange:

This subclass is indented under subclass 193. Process in which heat is transferred through a wall.

195 After separation of solid from contact liquid:

This subclass is indented under subclass 187. Process in which the contact liquid is recycled or reused after a solid is removed from the contact liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 189, and 205, for other processes of separating a solid from the contact liquid.

196 By filtration:

This subclass is indented under subclass 195. Process in which the contact liquid containing the solid to be removed is passed through a foraminous or porous mass which separates the solid from the liquid by entrapment and retention while permitting the liquid to pass through.

197 By gravity separation:

This subclass is indented under subclass 195. Process in which the solid settles to the bottom of a mass of the contact liquid in a settling tank or the solid rises to the top of a mass of the contact liquid in a flotation tank due to the difference in density of the solid and the contact liquid, with the layer of the contact liquid containing the solid being separated from the remainder of the mass of contact liquid.

198 And deflection to remove liquid particles from gas:

This subclass is indented under subclass 187. Process in which the gas and liquid after contact impinge on a surface to effect an abrupt change in direction of the gas-liquid mixture or to guide the gas-liquid mixture to cause the liquid to drop out and remain behind while the gas flows on.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 216+, for other processes of liquid contacting and deflection.
- 267+, for deflection without liquid contacting.

199 Liquid contact in plural serial stages:

This subclass is indented under subclass 187. Process in which liquid and gaseous fluid mixture contact is effected in more than one step or zone in series.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

223+, for liquid contact in plural serial stages without recycle or reuse of the contact liquid.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 267+ for gas separation apparatus with gas and liquid contact means having diverse means for adding the liquid.

200 Removal of solid or liquid particles from gas:

This subclass is indented under subclass 199. Process in which solid or liquid particles are removed from a gas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

202, for removal of solid or liquid particles from gas in a single stage.

201 Reduction of pressure during liquid contact:

This subclass is indented under subclass 199. Process in which pressure is decreased during the liquid contact.

202 Removal of solid or liquid particles from gas:

This subclass is indented under subclass 187. Process in which solid or liquid particles are removed from a gas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

200, for removal of solid or liquid particles from gas in plural serial stages.

203 Reduction of pressure:

This subclass is indented under subclass 187. Process in which pressure is decreased.

204 And recycle of gas for further contact:

This subclass is indented under subclass 149. Process in which the gaseous fluid mixture or a separated gaseous constituent is recirculated for further contact with the liquid.

205 And separation of solid from contact liquid:

This subclass is indented under subclass 149. Process in which a solid is removed from the contact liquid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

189, and 195, for other processes of separating a solid from the contact liquid.

206 And separation of liquid from contact liquid:

This subclass is indented under subclass 149. Process in which a liquid constituent is removed from the contact liquid.

(1) Note. The liquid removed from the contact liquid may have been originally present as liquid particles entrained in a gas, or the liquid removed may have been originally present as vapors as part of a plurality of gases, in which case the vapors would have condensed to liquid because of the liquid contact.

(2) Note. In order for a patent to be placed here, the vapors sorbed by a liquid from a plurality of gases and removed from the liquid must be normally liquid at a temperature of 0°C and a pressure of 760 mm Hg and the vapors must have condensed to liquid (e.g., methanol (CH₃OH), ethanol (C₂H₅OH), etc.).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

156+, for liquid contact and removal of a gas from a liquid.

188+, for separation of a liquid constituent from the contact liquid with recycling or reusing the contact liquid.

207 By stripping with gas:

This subclass is indented under subclass 206. Process in which the liquid constituent is removed from the contact liquid by passing a

gas through or in contact with the contact liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

159+, for liquid contacting and degasification of liquid by stripping with gas.

191, for liquid contacting and separation of a liquid constituent from the contact liquid by stripping with gas with recycle or reuse of the contact liquid.

208 By reduction of pressure (e.g., flashing, etc.):
This subclass is indented under subclass 206. Process in which the liquid constituent is removed from the contact liquid by decreasing the pressure acting on the contact liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

172+, for liquid contacting and degasification of liquid by reduction of pressure.

192, for liquid contacting and separation of a liquid constituent from the contact liquid by reduction of pressure with recycle or reuse of the contact liquid.

209 By heating (e.g., fractional distillation, etc.):
This subclass is indented under subclass 206. Process in which the liquid constituent is removed from the contact liquid by heating the contact liquid (e.g., fractional distillation, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

178+, for liquid contacting and degasification of liquid by heating.

193+, for liquid contacting and separation of a liquid constituent from the contact liquid by heating with recycle or reuse of the contact liquid.

210 On surface extending mass:
This subclass is indented under subclass 149. Process in which the contact between the gaseous fluid mixture and the liquid takes place on a material which serves to increase the area for contact.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 290+ for gas separation apparatus in which gas and liquid contact takes place on particulate media,

shaped packing elements, or porous media.

211 Particulate media, fibrous media, or packing elements:

This subclass is indented under subclass 210. Process in which the surface extending mass consists of (a) a plurality of small, discrete solids (e.g., particulate bed, etc.), (b) a mass of slender, elongated material (e.g., a mass of wicklike or threadlike material, etc.), or (c) a mass of randomly oriented or positioned elements which may be molded, machined, or formed, that possess specific advantages of surface availability for gas and liquid contacting (e.g., Raschig rings, Berl saddles, Intalox saddles, Pall rings, etc.).

SEE OR SEARCH CLASS:

261, Gas and Liquid Contact Apparatus, subclasses 94+ for apparatus specially adapted to produce an intimate contact between gases and liquids including a stationary porous mass of material (not a sheet). See also digest 72 for packing elements.

212 And cleaning of particulate media, fibrous media, or packing elements:

This subclass is indented under subclass 211. Process in which the liquid or the separated constituent is removed from the particulate media, fibrous media, or packing elements.

213 Apertured partition member:

This subclass is indented under subclass 210. Process in which the surface extending mass has one or more openings through which the gaseous fluid mixture or liquid passes in order to increase the contact of the gas with the liquid (e.g., use of perforated plates, bubble cap trays, mesh screens, parallel wires, parallel bars, etc.).

SEE OR SEARCH CLASS:

261, Gas and Liquid Contact Apparatus, subclasses 108+ for apparatus specially adapted to produce an intimate contact between gases and liquids including stationary baffles over which the liquids flow in contact with gases. See particularly subclass 113 for perforated baffles and subclass

114.2 for apparatus utilizing bubble caps.

214 And filtration of gas:

This subclass is indented under subclass 149. Process in which a gas and solid or liquid particles entrained therein is passed through a foraminous or porous mass which separates the solid or liquid particles from the gas by entrapment and retention while permitting the gaseous or vaporous constituents to pass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

273+, for filtering without liquid contact.

281, for filtering with cleaning of the filter by use of a liquid.

215 Including movement of filter:

This subclass is indented under subclass 214. Process in which the filter is not stationary during filtration.

216 And deflection:

This subclass is indented under subclass 149. Process in which the gaseous fluid mixture, liquid, or the gaseous fluid mixture and liquid after contact (a) are impinged on a solid or liquid mass and the direction of flow is changed because of the impinging on the solid or liquid mass or (b) are contacted by a gas stream to effect an abrupt change in direction of flow.

(1) Note. The deflection may or may not cause separation of a constituent from the gaseous fluid mixture.

SEE OR SEARCH THIS CLASS, SUBCLASS:

198, for other processes of liquid contacting and deflection with recycle or reuse of the contact liquid.

267+, for separation of a constituent from a gas by deflection.

217 Liquid is in form of curtain:

This subclass is indented under subclass 216. Process in which the liquid falls through open space freely in a thin stream for gas-liquid contact.

218 Including movement of deflector:

This subclass is indented under subclass 216. Process in which the deflection is caused by a solid mass that is not stationary during deflection.

219 Including rotation of liquid, gaseous fluid mixture, or gas-liquid mixture through 360 degrees in stationary apparatus:

This subclass is indented under subclass 216. Process in which the liquid, gaseous fluid mixture, or gas-liquid mixture rotates or spins around an axis through 360° in an apparatus that does not move to cause the rotating or spinning.

220 With heating or cooling:

This subclass is indented under subclass 219. Process in which the gaseous fluid mixture, a separated constituent, the contact liquid, or apparatus involved in the process is heated or cooled.

221 Deflection in plural serial stages:

This subclass is indented under subclass 216. Process in which the deflection of the gaseous fluid mixture, liquid, or the gaseous fluid mixture and liquid after contact occurs in more than one step or zone in series.

SEE OR SEARCH THIS CLASS, SUBCLASS:

223+, for liquid contact in plural serial stages without deflection.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 267+ for gas separation apparatus with gas and liquid contact means having diverse means for adding the liquid.

222 Using diverse type deflectors:

This subclass is indented under subclass 221. Process in which two or more discrete deflectors are arranged one downstream of the other, at least two of the deflectors being of differing types.

- 223 In plural serial stages:**
This subclass is indented under subclass 149. Process in which the fluid mixture is contacted with a liquid in more than one step or zone in series.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
199+, for liquid contact in plural serial stages with recycle or reuse of contact liquid.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 267+ for gas separation apparatus with gas and liquid contact means having diverse means for adding the liquid.
- 224 Liquid sprays:**
This subclass is indented under subclass 223. Process in which the fluid mixture is treated in each zone or stage with liquid which has been finely dispersed.
- 225 With heating or cooling:**
This subclass is indented under subclass 224. Process in which the fluid mixture, a separated constituent, the contact liquid, or apparatus involved in the process is heated or cooled.
- 226 Gaseous fluid mixture discharged against or beneath surface of liquid body:**
This subclass is indented under subclass 149. Process in which the gaseous fluid mixture to be treated (a) impinges onto the top layer of a liquid contained in a reservoir or (b) is discharged beneath the top layer of a liquid.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 329+ for gas separation apparatus having a liquid bath or reservoir for gas and liquid contact.
261, Gas and Liquid Contact Apparatus, subclasses 121.1+ for devices specially adapted to produce an intimate contact between gases and liquids by means that discharges gas beneath the surface of the liquid.
- 227 With heating:**
This subclass is indented under subclass 149. Process in which the fluid mixture, a separated constituent, the contact liquid, or apparatus involved in the process is heated.
- 228 With cooling:**
This subclass is indented under subclass 149. Process in which the fluid mixture, a separated constituent, the contact liquid, or apparatus involved in the process is cooled.
- 229 Cooling before liquid contacting:**
This subclass is indented under subclass 228. Process in which the contact with a liquid occurs after the cooling.
- 230 Inorganic gas, liquid particle, or solid particle sorbed (e.g., vapor, mist, dust, etc.):**
This subclass is indented under subclass 149. Process in which an inorganic gas, liquid particle, or solid particle is separated from the plurality of gases or the gas with entrained liquid or solid particles by the contact with a liquid.
- (1) Note. For purposes of classification in this area, "inorganic" compounds or elements are those that would fall within the definition of Class 423. For example, the cyanides (CN joined only to a metal or to hydrogen) and the carbon oxides are found in the indented subclasses.
- 231 Water sorbed:**
This subclass is indented under subclass 230. Process in which water is separated.
- 232 Nitrogen or nitrogen containing compound sorbed:**
This subclass is indented under subclass 230. Process in which nitrogen (N₂) or a nitrogen containing compound is separated.
- 233 Halogen or halogen containing compound sorbed:**
This subclass is indented under subclass 230. Process in which a halogen (i.e., fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At)) or a halogen containing compound is separated.

234 Metal or metal containing compound sorbed:

This subclass is indented under subclass 230. Process in which a metal or a metal containing compound is separated.

235 Sulfur or sulfur containing compound sorbed:

This subclass is indented under subclass 230. Process in which sulfur (S) or a sulfur containing compound is separated.

236 Carbon dioxide sorbed:

This subclass is indented under subclass 230. Process in which carbon dioxide (CO₂) is separated.

237 Organic gas, liquid particle, or solid particle sorbed (e.g., vapor, mist, dust, etc.):

This subclass is indented under subclass 149. Process in which an organic gas, liquid particle, or solid particle is separated from the plurality of gases or the gas with entrained liquid or solid particles by the contact with a liquid.

- (1) Note. For purposes of classification in this area, "organic" compounds are those that would fall within the definitions of Class 260.

238 Alkyne sorbed (e.g., acetylene, etc.):

This subclass is indented under subclass 237. Process in which an alkyne (i.e., alkine) is separated (e.g., acetylene, etc.).

239 Cyclic compound sorbed:

This subclass is indented under subclass 237. Process in which a cyclic compound is separated.

240 Alkene sorbed:

This subclass is indented under subclass 237. Process in which an alkene (i.e., olefin) is separated.

241 DEGASIFICATION OF LIQUID:

This subclass is indented under the class definition. Process in which a gas is removed from a liquid.

- (1) Note. In order for a patent to be placed here, the gas removed from the liquid must be normally gaseous at a tempera-

ture of 0°C and a pressure of 760 mm Hg (e.g., hydrogen sulfide (H₂S), carbon monoxide (CO), carbon dioxide (CO₂), ethane (C₂H₆), ammonia (NH₃), etc.). If, however, a constituent is at a temperature above its boiling temperature for a particular pressure, then the constituent is presumed to be a gas, and a patent to a process for removing the constituent will be placed here when the constituent is initially present in gaseous phase in the liquid and is removed from the liquid as a gas.

- (2) Note. The removal of a volatile organic compound (e.g., ethanol (C₂H₅OH), gasoline, etc.) from a liquid is not taken to be degasification of a liquid for Class 95 when the volatile organic compound is initially present as a liquid mixed with another liquid. The removal of a volatile organic compound from a liquid may be found in Class 210 for liquid purification or separation or Class 203 for separatory distillation processes.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 30, for processes of degasification of a liquid by use of sound waves.
46, for processes of degasification of a liquid by selective diffusion of gases through a substantially solid barrier.
90+, for processes of degasification of a liquid by use of a solid sorbent.
156+, for processes of contacting a gas with a liquid and degasification of the contact liquid.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 155+ for degasifying means for liquid.
203, Distillation: Processes, Separatory, for processes for separating a liquid mixture by vaporizing and condensing at least a portion thereof to isolate in the condensed liquid (distillate) or in the unvaporized portion (residue) a comparatively pure compound that was present as such in the original mixture.

- 210, Liquid Purification or Separation, for processes of removing a volatile organic compound from a liquid wherein the volatile organic compound is initially present as a liquid mixed with another liquid.
- 242 Defoaming:**
This subclass is indented under subclass 241. Process in which a frothy or sudslike dispersion is resolved or broken into separate fluid phases.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
155, and 157, for other processes of defoaming a liquid.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 176+ for defoaming apparatus.
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 115+ for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of foam colloid systems, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.
- 243 Plural successive degassing treatments:**
This subclass is indented under subclass 241. Process in which the liquid is subjected to more than one degasifying step, each step occurring at a different time than another step.
- 244 Boiler feed water degassing:**
This subclass is indented under subclass 243. Process in which the liquid that is degasified is the feed going to a steam generator, whether raw water or condensed steam.
- 245 By stripping with gas:**
This subclass is indented under subclass 243. Process in which in at least one of the degasifying steps the gas is removed from the liquid by passing a gas through or in contact with the liquid.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
83, and 84, for processes of eluting or displacing separated constituents from a chromatographic column comprising a liquid solvent on a solid base.
159+, for contacting a gas with a liquid and degasifying the contact liquid by stripping with gas.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 202+ for degasifying means for liquid with gas contacting means.
- 246 And reduction of pressure (e.g., flashing, etc.):**
This subclass is indented under subclass 245. Process in which the pressure acting on the liquid is decreased.
- (1) Note. The pressure reduction may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by stripping with gas, or the pressure reduction may be used in order to aid the removal by stripping with gas.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
160+, for contacting a gas with a liquid and degasifying the contact liquid by stripping with gas and reduction of pressure.
247+, and 266, for degasification of liquid by reduction of pressure.
- SEE OR SEARCH CLASS:
96, Gas Separation: Apparatus, subclasses 193+ for degasifying means for liquid of the pressure reducing type.
- 247 By reduction of pressure (e.g., flashing, etc.):**
This subclass is indented under subclass 243. Process in which in at least one of the degasifying steps the gas is removed from the liquid by decreasing the pressure acting on the liquid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 172+, for contacting a gas with a liquid and degasifying the contact liquid by reduction of pressure.
- 266, for degasification of liquid by reduction of pressure.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 193+ for degasifying means for liquid of the pressure reducing type.

248 And liquid flow modifying or mechanical agitating:

This subclass is indented under subclass 247. Process in which the liquid is mixed, stirred, or turbulated by contact with a solid member or the flow path of the contact liquid is altered.

- (1) Note. The liquid flow modifying or mechanical agitating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by reduction of pressure, or the liquid flow modifying or mechanical agitating may be used in order to aid the removal by reduction of pressure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 185, for contacting a gas with a liquid and degasifying the contact liquid by liquid flow modifying or mechanical agitating.
- 260+, for degasifying liquid by liquid flow modifying or mechanical agitating.

249 And heating:

This subclass is indented under subclass 248. Process in which the liquid or the gas is heated.

- (1) Note. The heating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by reduction of pressure or liquid flow modifying, or the heating may be used in order to aid the removal by reduction of pressure or liquid flow modifying.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 156+, for liquid contacting and degasification of the contact liquid by heating.
- 251+, for degasifying liquid by heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

250 And heating:

This subclass is indented under subclass 247. Process in which the liquid or the gas is heated.

- (1) Note. The heating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by reduction of pressure, or the heating may be used in order to aid the removal by reduction of pressure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 156+, for liquid contacting and degasification of the contact liquid by heating.
- 251+, for degasifying liquid by heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

251 By heating:

This subclass is indented under subclass 243. Process in which in at least one of the degasifying steps the gas is removed from the liquid by heating the liquid.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 156+, for liquid contacting and degasification of the contact liquid by heating.
- 247+, for degasifying liquid by reduction of pressure and heating.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclass 218 for heat exchange apparatus to degasify liquid.

252 And liquid flow modifying or mechanical agitating:

This subclass is indented under subclass 251. Process in which the liquid is mixed, stirred, or turbulented by contact with a solid member or the flow path of the contact liquid is altered.

- (1) Note. The liquid flow modifying or mechanical agitating may be used in a separate step in order to remove gas from the liquid in addition to the step of removing gas from the liquid by heating, or the liquid flow modifying or mechanical agitating may be used in order to aid the removal by heating.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 185, for contacting a gas with a liquid and degasifying the contact liquid by liquid flow modifying or mechanical agitating.
260+, for degasifying liquid by liquid flow modifying or mechanical agitating.

253 Emulsion breaking or multiple liquid separating:

This subclass is indented under subclass 241. Process in which two liquids are separated, one of which (a) is originally finely dispersed in the other, as in an emulsion, or (b) is mixed in and flows with the other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 188+, and 206+, for contacting a gas with a liquid and separation of the liquid from the contact liquid.

SEE OR SEARCH CLASS:

- 55, Gas Separation, subclass 421 for gas separation apparatus which has means to separate a liquid from a mixture with one or more additional liquids.
96, Gas Separation: Apparatus, subclasses 182+ for degasifying means for liquid which has means to separate a liquid from a mixture with one or more additional liquids.
210, Liquid Purification or Separation, for liquid purification or separation, and see particularly subclass 708 for emulsion breaking.

- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 135+ for processes of or compositions for or subcombination compositions for the breaking of or inhibiting of emulsion colloid systems, by addition of chemical agent or by action of physical agent, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

254 And subsequent handling of evolved gas, stripping gas, or residue liquid:

This subclass is indented under subclass 241. Process in which the removed gas, a stripping gas, or the remaining liquid is further treated or used in some manner involving more than mere removal from the system.

255 Evolved gas removed by sweep gas:

This subclass is indented under subclass 254. Process in which a purge gas is used to carry off the removed gas.

256 For indirect heat exchange:

This subclass is indented under subclass 254. Process in which the removed gas, the stripping gas, or the remaining liquid is used to transfer heat to or to accept heat from any material through a solid wall.

257 Gas condensed:

This subclass is indented under subclass 256. Process in which the removed gas or the stripping gas is the heat exchange medium and is condensed to liquid.

258 Gas recycled or further separated:

This subclass is indented under subclass 254. Process in which (a) the removed gas is used to further strip gas from the liquid, (b) the stripping gas is recovered and is used for further stripping of gas from the liquid, or (c) the gas is subjected to an additional separating treatment.

259 Liquid further separated:

This subclass is indented under subclass 254. Process in which the remaining liquid is subjected to an additional separating treatment.

260 By liquid flow modifying or mechanical agitating:

This subclass is indented under subclass 241. Process in which the gas is removed from the liquid by mixing, stirring, or turbulating by contact with a solid member or the flow path of the liquid is altered.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 185, for contacting a gas with a liquid and degasifying the contact liquid by liquid flow modifying or mechanical agitating.
- 248+, and 252, for plural successive liquid degassing treatments which include liquid flow modifying.

261 Centrifugal force:

This subclass is indented under subclass 260. Process in which the gas is removed from the liquid by the effect of centrifugal action which causes the liquid with gas entrained therein to assume a rapid arcuate or circular movement.

262 Impinging on baffle:

This subclass is indented under subclass 260. Process in which the gas is removed from the liquid by causing the liquid with gas entrained therein to contact a solid surface in the flow path of the process in order to redirect or alter the flow path and to cause separation of the gas from the liquid.

263 By stripping with gas:

This subclass is indented under subclass 241. Process in which the gas is removed from the liquid by passing a gas through or in contact with the liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 83, and 84, for processes of eluting or displacing separated constituents from a chromatographic column comprising a liquid solvent on a solid base.
- 159+, for liquid contacting and degasification of the contact liquid by stripping with gas.
- 245+, for plural successive liquid degassing treatments which include stripping with a gas.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 202+ for degasifying means for liquid with gas contacting means.

264 Steam is stripping gas:

This subclass is indented under subclass 263. Process in which the stripping gas is steam.

265 Nitrogen is stripping gas:

This subclass is indented under subclass 263. Process in which the stripping gas is nitrogen (N₂).

266 By reduction of pressure (e.g., flashing, etc.):

This subclass is indented under subclass 241. Process in which the gas is removed from the liquid by decreasing the pressure acting on the liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 160+, for processes of liquid contacting and degasification of liquid by stripping with gas in which there is reduction of pressure.
- 172+, for liquid contacting and degasification of liquid by reduction of pressure.
- 247+, for plural successive liquid degassing treatments which include reduction of pressure.

SEE OR SEARCH CLASS:

- 96, Gas Separation: Apparatus, subclasses 193+ for degasifying means for liquid of the pressure reducing type.

267 DEFLECTING:

This subclass is indented under the class definition. Process in which solid or liquid particles are removed from a gas by causing the gas and solid or liquid particles entrained therein (a) to contact a solid surface to effect an abrupt change in direction of the gas which (i) causes the solid or liquid particles to drop out and remain behind while the gas flows on or (ii) causes the solid or liquid particles to move to the outer periphery of a rotating gas stream in a concentrated layer to permit such layer to be separated from the gas with fewer or no entrained particles or (b) to contact a gas stream to effect an abrupt change in direction

of the gas which causes the solid or liquid particles to drop out and remain behind while the gas flows on.

SEE OR SEARCH THIS CLASS, SUBCLASS:

31+, for processes of separating a plurality of gases into constituent parts by making use of differences in molecular velocity, density, or momentum of gases.

198, for processes of contacting a gas with a liquid and deflection to remove liquid from gas with recycle of contact liquid.

216+, for processes of contacting a gas with a liquid and deflection.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 434+ for deflectors.

268 **And filtering:**

This subclass is indented under subclass 267. Process in which a gas and solid or liquid particles entrained therein is passed through a foraminous or porous mass which separates the solid or liquid particles from the gas by entrapment and retention while permitting the gaseous or vaporous constituents to pass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

273+, for filtering without deflection.

269 **Centrifugal force:**

This subclass is indented under subclass 267. Process in which the solid or liquid particles are removed from the gas by the effect of centrifugal action causing the gas and the solid or liquid particles entrained therein to assume a rapid arcuate or circular movement, with this movement causing the constituents of the mixture to separate into more or less distinct layers, depending upon the density of the constituents.

SEE OR SEARCH THIS CLASS, SUBCLASS:

34+, for processes of separating a plurality of gases into constituent parts by making use of centrifugal force.

270 **Created by rotating equipment:**

This subclass is indented under subclass 269. Process in which the centrifugal force is caused by a rotating element moving around an axis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

35, for processes of separating a plurality of gases into constituent parts by making use of centrifugal force in rotating equipment.

271 **Tangential gas inflow (e.g., cyclone, etc.):**

This subclass is indented under subclass 269. Process in which the gas enters deflecting apparatus in a path other than one that intersects or is parallel to the longitudinal axis of the apparatus.

272 **Tortuous flow path:**

This subclass is indented under subclass 267. Process in which the gas passes through an apparatus in a path that is repeatedly turned or bent.

273 **FILTERING:**

This subclass is indented under the class definition. Process in which a gas and solid or liquid particles entrained therein are passed through a foraminous or porous mass which separates the solid or liquid particles from the gas by entrapment and retention while permitting the gaseous or vaporous constituents to pass through; and subcombinations of gas filtration processes that do not result in separation (e.g., cleaning of a filter, etc.) when the subcombinations are not provided for elsewhere.

- (1) Note. A filter (particulate solids or other) has no "chemical" affinity for a constituent of a fluid mixture. The separation in the case of a filter depends on a mechanical entrapment of solid or liquid particles because of their relatively large size compared with the interstices or spaces between individual elements of the filter. The retained particles can be removed by brushing, wiping, shaking, or similar mechanical action.

A solid sorbent is a solid material which separates a constituent (e.g., a gas, vapor, etc.) from a fluid mixture containing

such constituents in a “quasi-chemical” manner. The action in most instances is that of selective retention (i.e., the sorbent removes only the part of the fluid mixture for which it has the greatest affinity). The retained constituent cannot be removed by shaking, brushing, or similar mechanical action, but generally can be removed by heating, pressure reduction, or use of a stripping or denuding fluid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

214+, for processes of contacting a gas with a liquid and filtration of the gas.
268, for processes of filtering with deflection.

SEE OR SEARCH CLASS:

55, Gas Separation, appropriate subclasses for filters.

274 Through particulate solids:

This subclass is indented under subclass 273. Process in which the mass comprises a plurality of small, distinct, separate, nonfilamentous solids.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 512+ for filtering apparatus including means for securing or retaining a mass of particulate solids during use as a filter medium.

275 Moving bed:

This subclass is indented under subclass 274. Process in which a bed of solid particles is constantly in motion during the separation.

SEE OR SEARCH CLASS:

55, Gas Separation, subclass 474 for apparatus in which a bed of particulate solids is agitated or caused to be moved to different zones during normal use thereof.

276 With cleaning of filter bed:

This subclass is indented under subclass 274. Process in which the separated solid or liquid particles are removed from the particulate solids.

277 Moving filter:

This subclass is indented under subclass 273. Process in which the filter is in motion during the separation.

278 With cleaning of filter:

This subclass is indented under subclass 273. Process in which the separated solid or liquid particles are removed from the filter.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 301+ for cohesive filter cleaning means.

279 By use of gas:

This subclass is indented under subclass 278. Process in which the separated solid or liquid particles are removed from the filter by contacting the filter with a gas, usually in a direction opposite that of the process fluid flow during separation.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 302+ for cohesive filter cleaning means using pneumatic reverse flushing.

280 Pulsed gas flow:

This subclass is indented under subclass 279. Process in which the pressure of the gas that contacts the filter in order to remove the separated solid or liquid particles increases and decreases periodically.

281 By use of liquid:

This subclass is indented under subclass 278. Process in which the separated solid or liquid particles are removed from the filter by contacting the filter with a liquid, usually in a direction opposite that of the process fluid flow during separation.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 233 for gas separation apparatus having means using liquid to clean a filter.

282 By mechanical manipulation:

This subclass is indented under subclass 278. Process in which the separated solid or liquid particles are removed from the filter by effecting filter motion or a relative movement among

portions thereof whereby accumulations are removed or prevented.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 304+ for cohesive filter cleaning means using filter manipulation.

283 With heating of filter:

This subclass is indented under subclass 273. Process in which the filter is heated.

284 And reduction of pressure:

This subclass is indented under subclass 273. Process in which the pressure acting in the process is decreased.

285 Coated or chemically treated filter:

This subclass is indented under subclass 273. Process in which the filter is coated or in which the filter is treated with a chemical before its use for filtration.

286 Plural separate media:

This subclass is indented under subclass 273. Process in which at least two filters that are spaced apart are used.

SEE OR SEARCH CLASS:

55, Gas Separation, subclasses 482+ for two or more spaced filters in a flow line or casing.

287 In series:

This subclass is indented under subclass 286. Process in which the filters are placed one after the other in succession.

SEE OR SEARCH CLASS:

55, Gas Separation, subclass 485 for three or more serially spaced filters.

288 HEAT EXCHANGING:

This subclass is indented under the class definition. Process in which there is transfer of heat.

- (1) Note. The heat transfer steps must be part of a larger process containing subject matter for Class 95. If the only separation involved is conducted by indirect heat transfer steps, then classification in Class 165 is proper. However, Class 95 does take cold wall-hot wall thermal dif-

fusion and condensing a constituent of a gas to the solid state.

SEE OR SEARCH CLASS:

- 62, Refrigeration, appropriate subclasses for specialized refrigeration arrangements. See the class definition of Class 95 for an amplification of the line.
- 165, Heat Exchange, appropriate subclasses for heat exchange apparatus or processes. See the class definition of Class 95 for an amplification of the line.

289 Cold wall-hot wall thermal diffusion:

This subclass is indented under subclass 288. Process in which the separation occurs by contacting the plurality of gases with plural surfaces of different temperatures to cause migration of gaseous constituents to one surface or another.

- (1) Note. This subclass takes specific refrigerating steps for maintaining the cooler wall at the lower temperature.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclass 221 for corresponding apparatus. Patents are not cross-referenced from Class 96, subclass 221 to this subclass based only on disclosure. Therefore, relevant disclosures of gas separation processes may be found in the apparatus area.

290 Condensing to solid:

This subclass is indented under subclass 288. Process in which the separated constituent is caused to pass to the solid state.

291 MISCELLANEOUS:

This subclass is indented under the class definition. Process not otherwise provided for above.

CROSS-REFERENCE ART COLLECTIONS

The following subclasses represent a collection of patents found elsewhere in the classification of this class, but merit isolation for aid in searching certain concepts which do not form appropriate bases for the placement

of original patents. These concepts are as given in the titles and definitions of the subclasses listed hereunder.

The cross-reference patents contained in these collections may be of further assistance to the searcher, either as a starting point in searching this class or as an indication of further related fields of search inside or outside the class. Thus, there is provided here a further path of access for retrieval of a limited number of types of disclosure.

- (1) Note. Disclosures are placed in these subclasses for their value as references and as leads to appropriate main or secondary fields of search, without regard to their original classification or their claimed subject matter.
- (2) Note. The disclosures found in the following subclasses are only examples of the indicated subject matter, and in no instance do they represent the entire extent of the prior art.

900 SOLID SORBENT:

Solid sorbent as provided for use in this class in which particular details are disclosed about the solid sorbent.

- (1) Note. Merely stating that a solid sorbent, activated carbon (C), or molecular sieve is used is insufficient to cause a patent to be placed here.

SEE OR SEARCH CLASS:

502, Catalyst, Solid Sorbent, or Support
Therefor: Product or Process of Making, for solid sorbents.

901 Activated carbon:

This subclass is indented under subclass 900. Solid sorbent as provided for use in this class in which particular details are disclosed about the activated carbon (C), which is a highly absorbent carbon obtained by heating granulated charcoal, obtained from vegetable matter, to exhaust contained gases.

902 Molecular sieve:

This subclass is indented under subclass 900. Solid sorbent as provided for use in this class in which particular details are disclosed about the molecular sieve which is usually a natural or synthetic metal aluminum silicate.

- (1) Note. The separation is similar to filtration in that the interstices of the molecular sieve particle accept and retain only those molecules which are smaller in size than the interstices.

903

Carbon:

This subclass is indented under subclass 902. Solid sorbent as provided for use in this class in which the molecular sieve material is carbon (C).

END